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THE EDUCATION OF THE ENGINEERING WORKER.

OUR own columns, as well as those of contemporaries and the proceedings of scientific societies, testify to the perennial interest which is excited by the subject of the training of engineers. The kindred topic, that of training for the industrial side of engineering, has not hitherto received the same amount of attention.

There are several reasons for this. Possibly the one which is most responsible is that those who consider the subject, and express views upon it, are themselves engineers, and not artisans. This is very likely a subconscious reason, but it is certainly true that many men first begin to think on the subject after this style:—"How could I have been better trained to do the work I have been called upon to do since I left college? What course would I adopt if I had to do it all over-again, knowing what I now know of the conditions obtaining in real business?" Then the man who went to college first thinks he might have learnt discipline and application if he had only had a year in the works first; on the other hand, the man who went to the works first thinks he would have known a great deal more of the working of machines, of the nature of processes, and of what goes on generally in the shops, if he had had some technical training first.

A paper read before the Manchester Local Section of the Institution of Electrical Engineers, on Tuesday, February 23rd, by Mr. A. P. M. Fleming, represents, we believe, the first attempt to bring this matter before our Institution as a body. We give elsewhere an abstract of this paper, which, ably compiled and presented to the meeting in an attractive manner, evoked an interesting and, we think, an important discussion.

Two further possible reasons for the neglect of the subject of the training of those who will work at the bench all their lives were brought out in the discussion: one, that there are so many more to deal with, and they have, as a general rule, less money and less time available for spending upon their education; the other, that undoubtedly skilled direction is the first essential, because it can frequently get good results even out of imperfectly-trained men, though not at the highest rate of efficiency.

Like everyone else who has handled the problem, Mr. Fleming finds that boys leave school in a very incompletely educated state. The necessity for imparting general instruction, as outlined in his paper, and as revealed in the apprenticeship rules of large firms of engineers and shipbuilders, and railway companies, should not exist. It is only of recent years that teaching, or to use the inharmonious title which has been bestowed upon it by those in authority, pedagogy, has itself become a subject of University rank. We believe that elementary subjects, or, as Mr. Peck would say, fundamental principles, are nowadays put before children in a far more attractive manner than was formerly the case. Children of school age are at the most impressionable period of their lives, and they can, and do, remember those things which attract their interest and appeal to their imagination.

The use of the scientific imagination may lead us into strange errors at times, but it is only by its aid that we are redeemed from being unable to see the wood for the trees. The imagination must be cultivated, and in this connection we may refer our readers to a recent issue of the *General Electric Review*, containing an article describing the apprentice system at the works of the General Electric Co. of America, at West Lynn, Massachusetts. The demands of theory upon the imagination are found to be best brought

home to the mind of the young man by concrete representation of the different truths which are taught him.

The absence of proper co-ordination between employers and educational authorities is another thing of which every one who is interested in this subject cannot fail to become unpleasantly cognisant. Mr. Eustace Thomas thinks that the very fact of having schools at works at all is evidence that practical men distrust technical teaching; and his does not seem to be an entirely isolated opinion. Mr. Fleming argued in his reply—which will, we understand, be amplified in the *Journal*—that the works was the proper place to have the school, because by having it there it was possible to get to know the boy himself. As a rule, of course, the teacher never works, and the worker never teaches. Mr. Thomas is himself a notable exception, for he has had years of teaching experience, and now engages in manufacture. Prof. Miles Walker is another, for he was for many years connected with the British Westinghouse Co., and now teaches.

It will already have occurred to the reader that not every works can run an apprentices' school. We are certain, however, that it could be done in more cases than those which now exist, only then we come up against the attitude of "we can't take the risk" of spending—or rather, investing—the capital, to which notice has recently been drawn in another connection.

Even where manufacturing concerns are very small, much might be done by co-operation. Mr. Fleming draws attention to what has been done by Dr. Kirschensteiner at Munich, and to quote:—"In this centre, around which there are a number of comparatively small industrial works, separate classes are arranged for the youths of each trade, and in these classes, apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors." This system could surely be applied among the numerous metal workers of Birmingham and the Midlands, and the small cutlers and silversmiths of Sheffield, to take only two examples. Co-operation would lead in time to nationalisation, the desirability of which was alluded to by Prof. Walker.

We must not conclude without mentioning the noteworthy fact that financial restrictions are almost entirely removed at the British Westinghouse works. Many promising youths who would otherwise be precluded from obtaining proper training can now improve themselves and make progress, and the benefit is mutual between them and their employers. The apprentice should not be looked upon as part of the machinery, and to obtain the best results employers should remember the important psychological facts that the growing and developing youth needs to be self-supporting—hence he should have a wage better than an unskilled labourer's; to be properly fed—hence not to go too long between meals; and to get proper rest—hence not to be pushed on to overtime as if he were full-grown and well skilled. The recently-published report of the L.C.C. psychologist, Mr. Cyril Burt, is a document which should be studied by those who hope to advance our national well-being in this direction.

Lead.

There was recently a sharp fall in the price of lead, but it proved to be but transient, and with a renewal of buying upon a moderate scale, and a less defined desire to liquidate metal, the market experienced a good rally, and to-day the level of prices is once more above the £20 level. The weakness which was noticed about a month ago had its origin to a great extent in the tactics of leading dealers, who apparently apprehensive of the United States forcing metal upon the London market to the detriment of the general situation, seized what they regarded as their opportunity and forced down the price. This effectually stopped the offers of American lead, and with a capital demand springing up at the cheaper range of prices then established, there was a steady and sustained upward movement. The fundamental position is sound so far as can be ascertained, the stocks in the United States being very moderate, the returns just available showing that at the end of December the accumulation of foreign lead in American bonded warehouses was only 6,800 tons, or about the same as a month previously, while elsewhere there is no excess of metal apparent. Here there are such difficulties experienced in regard to the discharging of steamers reaching here from Australia and elsewhere that it is sometimes rather hard to get hold of lead out of vessels, and this now and again causes a certain amount of trouble to the trade. The excessive cost of freight is an additional factor contributing to maintain a firm tendency about the market, for it makes it a costly matter to ship lead. There has been a considerable quantity of the metal in Spain awaiting disposal, and it had been feared that this must have a sobering effect upon prices, if the time came for it to be realised, but it now appears that the bulk of this has been sold to France, which country is still a consumer of lead upon an enormous scale, as, too, are all the warring nations, in connection with their military needs. Russian buying has been a matter of great importance for a long time; Russia has been actually taking lead for shipment from America to Vladivostock, and there is still a demand reported for material for prompt dispatch. There is not much chance of this demand persisting so far as the United States is concerned, for the time is getting near when it will be possible again to ship material to Russia by way of Archangel, and the opening up of the Dardanelles is bound to make an enormous difference to the entire course of the campaign in Europe. When the seas are swept clear of the baby-killers and their atrocity-friends the Turks, a very definite forward step will have been taken for bringing the "War Lord" to his knees. The general trade demand for lead is poor taking things all round, and the requirements for military purposes constitute the most important branch of consumption. Sellers are less disposed to operate, and the continuance of a pretty firm condition is generally expected. Of course, an improvement in the shipping facilities would mean a good deal to importers, and the more expeditious handling of goods at the Docks would assist to bring down prices of all commodities, but it is probably too much to look for any material relaxation of the difficult attitude of labour, which is partly responsible for the congestion and undue raising of prices.

The I.M.E.A.

In our "Notes" columns we are able to-day to publish some exceptionally interesting information regarding the work of the Incorporated Municipal Electrical Association. We have on previous occasions referred to the strong position which this Society has attained in the electrical world, where its active policy contrasts with the passive attitude of certain other organisations, and it will be observed that the Development Committee, which, with members co-opted from all branches of the industry, is a very substantial and representative body, is about to commence operations in several directions where progress is urgently needed. The constitution of the Committee reflects the liberal views of the Association, and we may be assured that no pedantic or academic scruples regarding commercial matters will hamper its proceedings.

In effect, the Development Committee takes the place that might have been occupied by the Industrial Committee of the I.E.E., and also will discharge the functions of the Society for Electrical Development of the U.S.A., to which we have frequently referred in these pages, and which is officially represented on the Committee. It will be noted, too, that the Sub-Committees themselves are empowered to co-opt persons whose help may be of value, a procedure which is of the greatest service, and ought to be practised in all departments of the State, from the highest to the lowest, but nevertheless is rarely adopted.

The decision of the Council of the I.M.E.A. to dispense with the customary Convention this year will receive general approval; business meetings, however, will be held, and it is significant that the principal features of these will be the presentation of reports by two active and energetic bodies which, like the Development Committee, have sprung from the I.M.E.A.

The Association is "going strong," and we heartily wish it success in all its undertakings.

WILL THE IGNITION MAGNETO BE SUPERSEDED?

By CHAS. J. WEBB, A.I.A.E.

The European war, although it has only been in progress seven months, has already wrought various unexpected changes, and has brought about many entirely unanticipated positions, some of which are in connection with the motor-car movement. Among those of interest, from an electrical point of view as well as to motorists, is that relating to the question of ignition. Up to the time of the outbreak of hostilities the makers of a certain magneto had built up such a strong position that, so far as the United Kingdom—one might say the whole of Europe—was concerned, practically every make of car was fitted with one or other models of the magneto in question. True, there were other types of magneto on the market, both at home and abroad, but they received such little encouragement, that their manufacture was only conducted on a relatively small scale, and it is probably from this cause that their construction was not brought to the same high standard of perfection as the German-made article.

There was, of course, a large stock of the latter in this country at the time war was declared, which will, doubtless, enable car manufacturers to carry on for some time, and, in the meantime, a number of magnetos which have hitherto not had their chance of "making good," and others emanating from new, but none the less experienced, firms are making their appearance on the market, so that, with the idea definitely removed that a car is useless unless fitted with the "one and only" type, it is probable that the magneto supply problem will not prove so serious as it appeared to be at the outbreak of the war.

In some quarters, however, the opinion is gaining ground that the outlook for magneto manufacturers is none too bright—that, ere long, the ignition machine they are manufacturing will be superseded. In other words, there is a growing feeling that, since electric lighting installations—practically all of which include a battery of accumulators—have become *de rigeur* on motor cars, there is no longer any need, seeing that a supply of the current needful for the spark is already available, for the additional complication of a magneto.

The Development of the Ignition Problem.

In the early days of the motor movement, as a few of the older motorists have good reason to remember, they having passed through experiences the modern car-owner can hardly imagine, the ignition of the explosive charge in the combustion chamber of the engine was effected by means of a costly platinum tube kept in a state of incandescence by means of a lamp or burner. This was duly superseded by ignition by means of accumulators and coil, which was eventually brought to a relatively high degree of perfection. The main difficulty which could not be overcome, and which in due course led to the introduction, or rather adoption, of the magneto, was that the battery in a short time became exhausted and required recharging. Sometimes, despite all the care that might be taken, the accumulators ran down unexpectedly, most probably as a result of short-circuiting, with the usual result of leaving the motorist stranded "miles from anywhere."

At first the ignition magneto was not the perfect and reliable article it is to-day, and it had a "long, long way" to go ere it won the entire confidence of motorists, dual ignition—accumulators and magneto—being for some years a leading item of the specification of all the principal cars. Gradually, as we all know, the magneto proved itself reliable, so that, finally, it came to be entirely and exclusively relied upon to furnish the vital spark. Yet, there are those who do not regard the magneto as the final form of ignition, especially in view of its one disadvantage that at low engine speeds it will frequently not fire the explosive charge in the cylinders, especially if the points of the sparking plug are dirty, or the mixture is not correct, it being in some quarters held that it was the difficulties experienced in this direction that led to the introduction of engine-starting devices.

The Doom of the Magneto Predicted.

The question as to whether the magneto will be superseded is not entirely a new one. It was first mooted some two or three years ago, when it was predicted that sooner or later it would have to fight for its position. The prediction was of course based on the increased popularity of electric lighting for cars. The need of a generator to supply the current for electric lighting, a battery of accumulators for equalising it, and the opportunity for employing the same medium for the starting of the engine were considered an irresistible combination compelling the use of the same equipment to furnish the ignition current, and, consequently, rendering the magneto superfluous. That the dynamo or generator could keep the battery constantly charged was considered as affording a further guarantee that the change would come about as predicted.

The matter is one that, owing to the greater, or perhaps, we should say, earlier popularity of electric lighting and engine starting installations, has received more attention in the United States than in this country, but the fact that the announcements relating to 1915 models made in America show a decrease of, approximately, 30 per cent. in the number of makes of cars fitted with magnetos seems to indicate that the time has arrived when magneto manufacturers in this country should turn their attention to the problem of evolving a combined system of lighting and ignition, and, possibly, engine starting, since they form the class which, obviously, has had the greatest experience of electrical apparatus as applied to motor vehicles. Since the lighting dynamo has been almost universally adopted, it has been possible to design a system of lighting and ignition that has all the advantages of accumulator ignition for starting, and the magneto for running, without any of the disadvantages of either system, and in which there is a large amount of current available at all times; in other words, the amount of current that would run down the batteries formerly used for ignition purposes will not be missed from the accumulators used for engine starting and car lighting, as the dynamo keeps them fully charged.

Early experiments appeared to indicate that an ignition system depending on the same source of energy as an engine-starting motor would not give reliable results, because of the weakening of the spark due to voltage drop when working the starter under adverse conditions. Engine-starting systems have, however, been greatly improved, with the result that specialists in America are now claiming that a point has been reached when no such fears need be entertained.

The New Generator-Battery Ignition System.

The generator-battery system, as the modern method is called, introduces nothing new, but, rather, is claimed to eliminate one piece of apparatus about a car, and utilises the equipment already on most vehicles. On starting, the ignition current is taken directly from the accumulators, the latter being what is termed floating on the line. When the engine is in full operation the dynamo starts to supply the current at the proper rate to the battery, and in sufficient quantity not only to supply current for lighting and ignition, but also to keep the battery fully charged.

There is nothing radically new in the components of a combination lighting, starting, and ignition system; there is no connection between them, except that they draw the necessary current from the same ultimate source—the generator. The wiring circuits are entirely independent, that connected with the ignition conducting the low-tension current from the battery to a non-trembler induction coil, the high-tension current from the latter passing through a mechanical circuit-breaker and distributor of practically the same design and construction as used in a magneto. It is claimed for the combination system that since a "fat" spark is obtained at low as well as high motor speeds, the carburetter may be set to work with a weaker mixture than usual, and that, consequently, the petrol consumption is reduced. Furthermore, there is no logical reason why equal engine speeds should not be obtained with the generator-battery system as with the magneto, while the engines may be throttled down to a lower degree than is possible with the magneto. Among other advantages claimed for the system are that the current is of a constant intensity, since it does not depend on the speed of the engine, while,

as there are no tremblers on the coil, perfect synchronism is obtained in the distribution. We do not overlook the fact that the element of security may not be so great in the case of an installation that is serving a triple purpose, but, after all, this is a question not only of choosing a well-tried system but also of seeing that it is carefully installed, a good deal depending on the way the wiring is carried out.

Some Claims for the New System.

One of the most ardent advocates in this country of the doing away with the magneto is, of course, Mr. F. S. Bennett, of the Cadillac Motor Co., who, in a recent communication, stated that: "Frankly, I believe the magneto was doomed from the day that the combined unit system—lighting, starting, and ignition—was produced, and, fortunately, there is no need to lament its departure in the form it has been generally known, as an equally good ignition system, with the enormous advantage of a perfect form of lighting and self-starting, has arrived to take its place, and, I am convinced, will inevitably do so." Mr. Bennett, after three years' experience of the combination set employed on the car with which he is connected, states that he is to-day "more than ever convinced that the magneto, perfect as it is, is bound to be displaced in Europe, as it has been in America, by some such system. The power is absolutely the same on either generator or magneto ignition, and if there is any preference it lies with the newer system, as the engine will run slower without stopping, and has a wider range of control."

While, perhaps, it is too early for us to express a definite opinion on the new-comer in the field of ignition, yet the fact that it is making great progress on the other side of the Atlantic suggests that the time has arrived when serious consideration should be given to the subject in this country, for whenever a start is made in substituting the new generator-battery ignition for the magneto on British-built cars, past experience has shown that it will have to go through a period of development and trial until it attains the same degree of reliability at the hands of motorists as that of the present-day magneto.

Finally, although the question whether the war may have the effect of quickening the disappearance of the magneto in favour of the newer system may be an open one, it is sincerely to be hoped that the lesson which the war has taught us in connection with magnetos will be taken to heart, and that never again will anything like a monopoly in connection with any part of the automobile be allowed to establish itself within our borders.

IMPROVED METHOD OF MAKING JOINTS IN GUTTA-PERCHA-COVERED CORE.

By J. RYMER-JONES.

It is not an uncommon experience that joints in the gutta-percha core of picked-up cable, and sometimes even in new core, do not always remain as sound electrically as when first made. The cause of weakness is generally traceable to imperfect cohesion between the insulating coverings, due to one or other of the following:—

(*a*) Want of cleanliness when handling the joint.

(*b*) Moisture left between the coverings owing to insufficient lamping.

(*c*) Surface oxidation preventing intimate union between the coverings.

(*d*) Deterioration of the gutta due to stock cable not being continuously under water.

(*e*) Unequal shrinkage between the gutta of the core and the gutta coverings of the joint, especially at the ends, when subjected to a considerable and sudden change of temperature.

(*f*) Overheating with a too hot tooling iron, &c.

Remedies.—(*a*) The jointer's hands should be washed with coal tar naphtha to remove *ingrained* dirt, and then with wood naphtha, prior to washing with soap and water, and rinsing well.

The surface of both ends of the core should be washed with clean white linen steeped in wood naphtha, and also all the parts to be handled, otherwise the jointer's hands are likely to become dirty again.

(*b*) Exclusion of moisture is most effectually secured by using *no water*, and on no account should saliva be used to moisten the fingers or tools. While closing a seam and manipulating the gutta-percha coverings the fingers should be dipped in wood naphtha, or methylated spirit, preferably the former, which by evaporation makes the hand cool and less likely to perspire in hot climates. The trimming knife, scissors, and cutting pliers, should also be dipped in wood naphtha instead of in water as has hitherto been customary.

(*c*) Want of perfect cohesion between the gutta-percha coverings is generally due to oxidation, and, in the case of even *new* gutta-percha sheet, to the fact that the gutta surface has been in contact with the calender, while rolled into sheet, or exposed to the air. Even after washing the surface of two pieces of gutta-percha sheet with soap and water, rinsing well and drying, it is difficult to make them adhere tightly when lamped and pressed together. Compound greatly improves the cohesion, but it is not always as tenacious as it should be or evenly applied. The remedy is to renew the surface either *mechanically*, *e.g.*, with a fine but stiff steel wire brush applied all over the gutta sheet; or, preferably, by breaking and mixing the *surface* with a suitably hot tooling iron. As an alternative and much better expedient the surface of the gutta-percha sheet is renewed *chemically* by rubbing it with chloroform, or benzole, using a small flat pig's bristle brush for the purpose. These act as solvents, and if the surfaces of two pieces of gutta-percha sheet, so prepared, be lamped and pressed together the adhesion is very tight.

After moistening with chloroform, or benzole, the surfaces may be smeared with a thin film of gutta-percha chloroform or gutta-percha benzole *solution;* but the cohesion is very good without this solution.

Renewing the surfaces chemically or mechanically secures practically perfect cohesion between the gutta-percha coverings. In fact, cleaning the conductor with chloroform, coating with gutta-percha chloroform solution and lamping well, to evaporate excess of spirit, is also a preferable substitute for the *compound* usually employed; and, moreover, secures the electrical advantage of making the core more homogeneous.

(*d*) If the core surface be oxidised, as is frequently the case with *old picked-up cable*, it should be pared with a sharp trimming knife before commencing to draw down the lamped ends, otherwise a deteriorated surface will lose still more of its freshness by lamping and become porous. The new gutta-percha sheet will consequently not mix so well with the old core even when the latter is treated with the solvent or solution, and the joint will probably soon develop electrical weakness by leakage between the old and the new surfaces.

If the thickness of the old gutta-percha covering is very small, there is little chance of making a durable joint, and the old core had better be stripped and its value realised.

(*e*) The more intimate the union brought about between the gutta-percha coverings by chemically preparing their surfaces, the less likely is the joint to develop weakness under trying changes from wet to dry, to which a cable is sometimes subjected in storage tanks; or under unequal contraction and expansion between the core and gutta-percha sheet brought about by great and sudden changes of temperature.

Experimental Joints Made in Gutta-Percha Core.

Ends cleaned with wood naphtha or methylated spirit and thin film pared off with trimming before lamping and drawing down. Wood naphtha (*), or methylated spirit (†) used to moisten fingers and tools.

First Set of Joints.—**Picked up core** $\frac{\text{70 lb. cond.}}{\text{75 lb. G.P.}}$ **reinforced with extra 55 lb. G.P.:—Core** $\frac{\text{70 cond.}}{\text{75 + 55 G.P.}}$ §

Joint.		Clark's accumulation test:— Charge during 2nd min.	4th min.	420 volts Jan. 11th, 1915.
No. 32	Chatterton compound on strand and between G.-P. covering, as usual*	3½	2	
„ 33	Chatterton compound on strand and between G.-P. covering, as usual†	2½	1¾	
„ 35	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole. then coated with film of G.-P. benzole solution and well lamped*	3½	2¾	After soaking continuously for 187 days.
„ 39	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G. P. chloroform solution, and well lamped† ...	4¼	3	
„ 42	Same as No. 39, except that *no* G.P. chloroform solution used between G.-P. coats*	2½	1¾	
	§ Core used as standard of comparison ...	3	2¼	

Second Set of Joints.—Unused core (from stock) $\frac{\text{130 lb. cond.}}{\text{130 lb. G.P.}}$ ‡

No. 32	Chatterton compound on strand and between G.-P. covering, as usual*	2½	1¾	
„ 33	Chatterton compound on strand and between G.-P. covering, as usual†	5	4	
„ 36	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G.-P chloroform solution, and well lamped* ...	3½	2¼	
„ 36A	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, then coated with film of G.-P. chloroform solution, and well lamped† ...	9	7	
„ 38	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole, then coated with film of G.-P. benzole solution and well lamped†	6½	4¾	After soaking continuously for 139 days.
„ 42	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, but *no* G.-P. chloroform solution or compound used between G.-P. coverings*...	2¼	1¼	
„ 42A	G.-P. chloroform solution on strand (φ); 1st and 2nd coats washed with chloroform, but *no* G.-P. chloroform solution or compound used between G.P. coverings†	2	1¼	
„ 43	G.-P. benzole solution on strand (φ); 1st and 2nd coats washed with benzole, but *no* G.-P. benzole solution or compound between G.-P. coverings†	3	2	
	‡ Core used as standard of comparison	4½	3½	

NOTE.—Testing current on for four minutes, plug short-circuiting condenser during first and third minutes, and removed during second and fourth minutes.

φ No Chatterton compound used for this joint.

INDIAN NOTES.

[FROM OUR SPECIAL CORRESPONDENT.]

Calcutta Port Trust.—Before the war there was much congestion at the Calcutta jetties owing to the enormous increase in import shipping, and it was decided to increase unloading facilities and extend the docks. Accordingly orders were placed with Messrs. Pyne, Hughman & Co., after severe competition, for 13 two-ton electric goods lifts in 1913. Last month a repeat order was placed with the same firm for 17 electric goods lifts. This they claim to be the largest lift order ever placed in India with one firm.

Tata Hydro-Electric Scheme, Bombay.—This large enterprise is now nearing completion. The Lonavla dam is almost completed and the Walhwan dam should be ready by March next. Four generators and turbines with their auxiliary plant are completed, and the transmission line is in its last stages. With average luck energy should be available in the Bombay mills by the end of March to the extent of 40,000 horse-power.

The Times of India writes as follows of the undertaking:—"The scheme is going to banish smoke from Bombay. It is going to provide our industries with the most efficient motive power, so much smoother in its action than steam that it greatly increases the efficiency of machinery. It is going to stimulate industry by furnishing power far more cheaply than steam engines and boilers can be installed. It is going to provide a basis for fresh industries all along the country traversed by the transmission line and perhaps to facilitate the electrification of the suburban railways and Ghat sections of the Great Indian Peninsula Railway. Once cheap and abundant electrical energy is introduced into an industrial centre no one can place a limit on its usefulness. The present plans provide for about one hundred thousand horse-power, but the Ghats can supply such further quantity as may be necessary to meet the demands of the city."

I.E.E., Calcutta.—The local Centre of the I.E.E. held its opening meeting in Calcutta recently, and in the unavoidable absence of the Chairman (Professor Everett), Mr. A. K. Taylor read his opening address to a small but appreciative audience.

Delhi.—Mr. J. S. Pitkeathly, C.V.O., has returned from six months' leave in England, and has taken up his duties as electrical engineer, New Province, Delhi. During his absence Mr. F. W. Symes, his assistant, officiated in his stead and carried out his trying duties in a very able manner.

Karachi.—At the opening ceremony of the new City Electric Lighting Works recently, what is described in the newspapers as an epoch-making event in the civic history of Karachi, happened. In inviting the Commissioner to close the main switch to start the town supply, the Chairman of the Electric Corporation, the Hon. Mr. M. de P. Webb, incidentally referred to the war, remarking, "I am one of those who deplore the use of that stupid phrase 'business as usual,' because it reveals the boasting and bragging and pretending frame of mind which will assuredly be the ruin of Germany. Business is not as usual, and never can be until the war is ended." The Commissioner, in reply, denied that the adoption of the motto connoted boasting or bragging. Something more imperial than that, he went on to say, was implied. "Business as usual" was a plain announcement that despite all the terrors of war, without regard to the suffering of mind, body and estate that must inevitably result, every man and woman in the Empire would tackle the job that came to hand and would do his or her duty. The manner in which the Empire has lived up to its war-derived motto is sufficient indication that there was neither boasting nor bragging in its "business as usual." This pointed rebuke is considered by many to be not unmerited.

Metal Filament Lamps.—The price of most things, including electrical material, has gone up in India since the war began, except the rates for metal lamps. Due to the insane cutting of prices among Indian contractors, it is possible to buy 225-volt metal lamps in India in gross quantities at 14 annas, or one shilling and twopence each!

OUR LEGAL QUERY COLUMN.

"Enquirer" writes:—"I shall be glad if you will kindly give me information on the following circumstances:—

"A consumer on the municipal supply has several electric motors which have been in use for some years; supply is given at low pressure (100 volts). He has recently applied for supply to another motor, and is informed that he will receive supply at a higher pressure (200 volts), and for this it will be necessary to run a new cable across a street to his premises, and he is asked to give a guarantee that he will pay a minimum of 20 per cent. on the outlay in laying this new main.

"He has not been asked for a similar guarantee for his previous motors, and this one is simply an extension of his

installation. He pays the ordinary advertised rates for his current.

"Can the Corporation demand this guarantee?

"The consumer would be quite content to receive supply at the old pressure, but the Corporation explain that it would overload the main, and probably affect the lighting in the neighbourhood."

*** S. 27 (1) of the Schedule to the Electric Lighting (Clauses) Act, 1899, provides that "The undertakers shall, upon being required to do so by the owner or occupier of any premises situate within fifty yards from any distributing main of the undertakers . . . . give and continue to give a supply of energy . . . . subject to the following conditions. The cost . . . . of so much of any such electric lines as it may be necessary to lay for a greater distance than 60 ft. from any distributing main of the undertakers . . . . shall if the undertakers so require be defrayed by that owner or occupier."

Sub-section (2) of the same Section provides that: "Every owner or occupier of premises requiring a supply of energy shall (b), If required by the undertakers, enter into a written contract with them to continue to receive and pay for a supply of energy for a period of at least two years of such an amount that the payment to be made for the supply, at the rate of charge for the time being charged by the undertakers for a supply of energy to ordinary consumers within the area of supply, shall not be less than 20 per cent. per annum on the outlay incurred by the undertakers in providing any electric lines required under this Section to be provided by them for the purposes of the supply, and if required by the undertakers give to them security for the payment to them of all moneys which may become due to them by the owner or occupier in respect of any electric lines to be supplied by them." The foregoing provisions make it plain that in the circumstances mentioned by "Enquirer" the guarantee can be demanded. The undertakers are not *bound* to demand it; but if they do the demand must be met.

LEGAL.

Prepayment Meter Prosecution Dismissed.

At Wednesbury Police Court on Friday in last week, Florence Williams, Wednesbury, was charged with stealing electricity, the property of the Corporation.

The Town Clerk (Mr. T. Jones) prosecuted, and stated that on January 9th an employé of the Corporation went to defendant's house in order to change a shilling-in-the-slot meter for one taking pennies. The money in the meter was counted out, there being 7s. In addition there were two washers and a farthing. The indicator registered 8s., which showed that the farthing and the small washer had not used any electricity, but that the larger washer had. When the employé told defendant she was liable to be punished, she made reply that if she had had more washers she would have put more in the meter, as she had not had sufficient light for her money. The Town Clerk added that he did not press for a heavy penalty, but the practice could not be tolerated.

Evidence was given bearing out the above statement, and William Hunt, the employé, in examination, denied that he ever told defendant she could put in washers if she had not got a shilling.

Defendant, on oath, declared that the employé did tell her she could place a washer in the meter if she had not got a shilling, and make it right when the "state" was taken.

The Bench decided to dismiss the case.

Auto-Roto Syndicate, Ltd., *v.* Paul & Callard.

In the City of London Court, on Friday, before his Honour Judge Rentoul, K.C., plaintiffs, who are advertising contractors, of 32, Fenchurch Street, E.C., sued Messrs. Paul & Callard, High Street, Streatham, for £6, for 12 months' advertisements affixed to an electrically-propelled machine, at 10s. a month.

Mr. Louis Green appeared for the plaintiffs, and Mr. S. Duncan for the defendants.

There were three other cases against traders in Streatham, and it was agreed that the decision in the first case should determine the other cases.

Mr Green stated that the plaintiffs made a contract with the defendants on June 29th, by which they agreed to let defendants an advertisement for 12 months from its first showing on the plaintiffs' auto-roto machine, which was electrically propelled, and was affixed at the junction of Mitcham Lane and Streatham High Road to the side wall. Defendants were to supply suitable advertising matter, and it was to be subject to the approval of the plaintiffs. The money was payable in advance. The machine revolved with the advertisements upon it. A poster or sketch was prepared containing matter advertising defendants' business. Defendants approved of it, and although the machine was started in July the defendants were not charged until September. On August 28th defendants wrote and said that in accordance with the contract they gave notice that they required the immediate removal of their advertisement from the machine. That repudiation was ineffective. On September 2nd plaintiffs wrote and said the advertisement had started, and that having regard to the expense of preparing the poster they could not accept the repudiation of the order unless they paid for the first 12 months' rent. On September 3rd defendants replied that any legal claim did not affect their right to withdraw the advertisement of which they disapproved, or lessen their liability to carry out the instructions. They also said the machine was not placed in accordance with representations made as to the position, and that the sketch was bad. They further alleged that the machine was defective in working. There was no doubt that it raced because it was electrically driven. It did not work accurately. Sometime before September 1st plaintiffs' electrician got it into working order and controlled it. When the defects had been remedied and the machine got into working order, plaintiffs gave defendants notice that payment would begin. Therefore the defendants had had some of the advertisements for nothing.

Mr. Duncan said the permission of the Wandsworth Borough Council was not obtained by the plaintiffs before putting up the machine, and when it had been erected the Council told the plaintiffs to take it down or to put it in a different place. Where the machine was to have been placed the advertisement could be seen from the approaches in four roads, but where it had been placed it could only be seen in one road.

Mr. Green replied that there was no implied authority that the plaintiffs were to get the consent of the Borough Council. The machine was still up, and the advertisement was still running.

After hearing evidence the Court gave judgment for the defendants, with costs in each of the four cases.

Telephone Installation Case.

Sheriff Armour Hannay, Kirkcaldy, has heard parties in the preliminary pleas in an action at the instance of the Caledonian Telephone (New System) Co., Ltd., Glasgow, against Tullis, Russell & Co., Ltd., paper manufacturers, Auchmuty, Markinch. Pursuers asked the Court to ordain defenders to pay a sum of £137 19s., with expenses. They aver that on March 17th and 24th, 1914, defenders entered into two contracts with them for the installation of certain telephone instruments at a certain rental and under certain conditions. In terms of the contracts pursuers erected an installation in defenders' premises, the annual rental being £14 12s. Defenders aver that the contracts were signed only by their secretary, whereas in order to be binding on defenders they required under their articles of association to be sealed with the company's seal and subscribed on behalf of the company by two directors or by one director and the secretary. They maintained the contracts had been signed by their secretary under essential error, and that the error was induced by the pursuers or their representative, who was aware of this at the time. They aver that pursuers' representative assured their secretary that the quarterly or annual rent entirely covered the erection and capital cost of the installation. They repudiated liability for a period of 21 years or any other number of years. To save further trouble and expense they had already made a tender of £140. They aver that the contracts are not binding beyond the obligation to pay the annual rent so long as they retain and use the installation. His Lordship made avizandum.

Barcelona Traction, Light and Power Co.: Mackenzie *v* The Company.

On February 25th, in the Chancery Division, Mr. Justice Eve heard a motion in this matter.

Mr. Gore Brown, K.C., who appeared on behalf of Mrs. Byrne, one of the parties in the action, said his motion was that Mr. Whinney should be appointed Receiver of the company in the place of Mr. McAuliffe, the gentleman already appointed as Receiver. No suggestion was made against Mr. McAuliffe, but it was thought by Mrs. Byrne and her supporters that the interests of the bondholders would be better served if Mr. Whinney was appointed. The company was registered in September, 1911, and was formed under the laws of the Dominion of Canada, and its head office was at Toronto. It was formed for the purpose of developing water power and electric traction and tramways in Spain, and was, without doubt, a very large business. According to the balance-sheet of December 31st, 1913, which was the last one issued, there was outstanding capital of 27 millions of dollars in ordinary stock and 8 millions of dollars in preference stock. There was also an issue of 8 million pounds' worth of bonds, and it was with regard to this issue that the Receiver had been appointed, and the present application was made.

Mr. Justice Eve: These were bonds to bearer?

Counsel: Yes. Mr. Gore Brown added that Mrs. Byrne and others interested with her held a substantial number of the bonds, while the plaintiff, Mr. Mackenzie, held £20,000 worth and had received support from people holding altogether four millions.

Asked what were the grounds for his application, Mr Gore Brown said the action was commenced by Mr. Mackenzie really at the suggestion of the directors of the company, and while he was not suggesting any improper motive or dishonest conduct on the part of any of the gentlemen concerned, when they were dealing with the affairs of a company of this kind they wanted to be assured that the Receiver had an absolute independence of action. There was reason to believe that the Receiver worked with the directors to a certain extent, and received instructions from them, and when there was a working together in that way there could

not be the strictest and independent investigation which the matter demanded. Mr. McAuliffe was once a directer of the company, and was one of its auditors.

His Lordship said he understood that there was to be a scheme prepared, and when that came before the Court he would see that all the parties interested were protected.

Mr. Gore Brown said that would serve his purpose, and eventually the motion was adjourned and no order was made.

A.E.G. Electric Co. *v.* Semple.

At the Westminster County Court last week, the plaintiffs, of Oxford Street, London, sued defendant, a Battersea Park butcher, for £2 13s. 5d., the price of an ammeter supplied to him. Defendant said that when he ordered the instrument he thought that the plaintiffs were an English company, but he subsequently discovered that the company was composed of Germans, and that all the shares (£150,000), with the exception of seven, were held by Germans. He had also returned the instrument as defective, but they sent it back and he refused to take it in, and for some months it was in the possession of the L. & N.W.R. parcels delivery office. Plaintiffs said that the instrument was not defective. Defendant said that he refused to pay any money whatever so as to protect himself from being charged under the Defence of the Realm Act.

The Judge said that the defendant had now made his protest, but that was not to the point. He adjourned the case for defendant to call the man who fitted the instrument.

Ruthenberg *v.* British Abrasive Wheel Co.

Mr. Marcus Ruthenberg, the inventor of an electric furnace, was, on Monday, March 1st, plaintiff in an action before Mr. Pollock, High Courts Referee, against the defendants, of Victoria Street, Westminster, in which he sought to recover £976, balance of account for goods sold and delivered and for work done.

Mr. Tyler appeared for the plaintiff, and Mr. Clavel Salter, K.C., with Mr. Maddox, for the defendants.

According to the plaintiff's case, he was employed by the defendant company, whose business is to make abrasives, which are of intense hardness, for the purpose of making grinding wheels, to supply them with one of his electric furnaces at a cost of £1,100. To this was added £215 for additional gear and other matters, bringing up the total indebtedness to £1,376 16s., including £33 16s. paid by the plaintiff, on behalf of the defendants, to the Union Electric Co., Ltd. The defendants had paid two cheques of £200 each, reducing the balance to the amount claimed.

The defence was a general denial of indebtedness, and a counterclaim for £1,600, including the £400 paid on account, on the ground that the whole thing was worthless. The agreement between the parties was contained in the correspondence which passed, and a large number of letters were put in evidence, and it was said that by those letters, and partly verbally, the plaintiff agreed to supply an electric furnace of such construction that it could be worked in a satisfactory manner and smelt bauxite or alumina, pure or impure, into a fluid mass and make a product in every way the same as that made at Niagara Falls. The defendants said that there was an implied warranty, and that the furnace was defective and did not do its work properly. A portion of the plaintiff's claim was in respect of an amperemeter for each electrode reading to the maximum demands, and a voltmeter also reading to the maximum demands for the circuit, mounted on a slate panel. The plaintiff admitted the agreement, but denied that the transformer, or anything else, was defective as alleged, but alternatively said that if it was defective the transformer was rendered so by reason of the defendants having allowed the insulation to absorb moisture, and by reason of tests to which it was subjected by the defendants or their agents. He denied that he had committed any breach of the agreement, or that his work was defective, unless defects had been created by the furnace having been erected without proper skill by the defendants, and by working it in an improper manner.

(*To be continued.*)

Tungsten Drawn Wire.—Petition for Licence.

In the Chancery Division on Monday, March 1st, Mr. Justice Warrington commenced the hearing of a petition by the Robin Electric Lamp Co., Ltd., for a licence to make, use and vend tungsten wire in accordance with the inventions covered by the Tungsten Lamp Association patents, or any of them, upon payment of "such royalties as shall in the circumstances be deemed reasonable."

The petition was opposed by the British Thomson-Houston Co., Ltd., and Messrs. Siemens Bros. & Co., Ltd.

Mr. Bousfield, K.C., Mr. Cave, K.C., M.P., and Mr. R. Frost appeared for the petitioners; Mr. Walter, K.C., Mr. J. H. Gray and Mr. E. Lunge for the Thomson-Houston Co., and Mr. Colefax, K.C., and Mr. Hume for the Siemens Co.

Mr. Bousfield said the petitioners were a company formed to work a patent of Mr. Joseph Theodore Robin for a lamp which had two filaments instead of one. By such a lamp one secured this, that if one filament broke, a person could by giving a turn to an attachment to the lamp bring in another filament, so that the lamp started with a new lease of life. Since the day of the squirted lamp, the drawn-wire lamp had come in, and it was better as regarded both efficiency and durability. One's lamp bill might approach to something of the dimensions of the electricity bill; a little more durability in the lamp therefore made a great deal of difference, and 90 per cent. roughly of the lamps sold to-day were drawn-wire lamps. The petition recited the nine patents under which the petitioners asked for a licence. The patents were referred to as the Association patents. The B.T.H. owned a group of patents of American origin, and Siemens Bros. owned a group of patents of German origin. These two companies, together with the Osram Lamp Co. who owned another group of patents, pooled their patents. The total number of them was something like 150. They pooled their lamp patents and jointly granted licences to anybody who came into the Association, the main condition being that the member of the Association should sell to the retailer at a certain list price. The petitioners had taken out from the list the only nine patents that referred to the manufacture of the drawn wire. If they got a supply of drawn wire they would be content without the licence, because the sale of the wire carried the licence to use it; but not being able to get it they asked to have a compulsory licence. The petitioners had applied to the patentees and their various licensees for the supply of drawn tungsten wire covered by the Association patents, and had in each case been met with a refusal to supply wire or to grant a licence except in the case of the British Thomson-Houston Co., who, when applied to, offered to sell to the petitioners wire at 125s. per 1,000 ft. for lamps for 25 watts up to 100 watts at 100 volts. That price was wholly unreasonable and prohibitive, for with wire at that price the petitioners would not be able to place their lamp on the market with any reasonable prospect of success. The petitioners could obtain wire similar to that used by the patentees and their licensees in lamps sold under the protection of the Association patents from various sources abroad at a price of about 40s.

Counsel, commenting on the price proposed to be charged for the wire—125s. per 1,000 ft.—said the cost of manufacturing the lamp was 4d., and the price of the wire for a single-filament lamp would be 5d., and for a double-filament lamp 10d. A great deal would turn on what was a fair price. As members of the public the petitioners were entitled to be supplied with wire without questions being asked. But the patentees were holding up the price of wire on unreasonable terms in order to suit the purpose of a combination which was formed to keep up the price of electric lamps. A drawn-wire filament lamp which was sold here at 2s. 6d. could be purchased abroad for about 10d. The cost of the lamp was something under 4d. The filament cost ½d. As one group of patents was American and the other German, in the natural order of things they would have had two sets of manufacturers competing with each other and the price would have been kept down; but directly these two combined there were no competitors, and the combination fixed the price and said: "Unless you sell your lamps at this price we shall not supply you." There was obviously a fear in the mind of the Association that if the petitioners were to sell a double-life lamp at 2s. 9d., the public would not pay 2s. 6d. for a single-life. So the Association said:—"You must put 1s. on the price, or give us 1s. for the wire." The price of the lamp in Germany, where the German patents were running, was 1s. 9d., and in Holland, where the patent did not run, the price was 10d. A charge to the public of 3d. for two filaments would be quite reasonable, but they were asked to put on 1s. Counsel went on to say that competition had been artificially interfered with in this case by the two groups, and the combination was not entitled to ask for a royalty on the basis of that artificial condition of things, which was created by joining the groups together, so as to get rid of competition. This wire could be bought in the open market in Switzerland at a price which worked out at ½d. a metre.

(*To be continued.*)

Tramway Accident Claim.

The trial concluded in a Scottish Court of Session, on Friday, of the action in which a Johnstone doctor sued the Paisley District Tramways Co., for £500 damages for personal injuries and for damage to his motor car. The case arose over a collision between a tramcar and the doctor's motor. Defenders denied fault and pleaded contributory negligence. The jury returned a verdict for pursuer and assessed the damages at £400.

Fallon *v.* Middleton Electric Traction Co., Ltd.

At the Manchester Assizes, on February 24th, before Mr. Justice Sankey and a jury, the wife and two daughters of James Fallon, greengrocer and fishmonger, of Rochdale, who died as the result of an accident at Castleton, claimed damages, under Lord Campbell's Act, from the Middleton Electric Traction Co., Ltd. It was alleged that Fallon's death was due to the negligent driving of the defendant company's tramcar, which ran into the back of the cart that Fallon was driving. In the result, the widow was awarded £300 and the two daughters £25 each.

Osram *v.* Pope's Electric Lamp Co., Ltd.

In the Chancery Division on Tuesday, before Mr. Justice Eve, an application was made by Mr. C. Terrell for the postponement of the trial of this action. He said the ground was the convenience of counsel. The hearing was fixed for the 15th inst., but counsel (Mr. Russell Clark) was engaged on a great public duty, and he could not be ready before the 25th inst.

Mr. A. J. Walter, K.C., said that would only leave four working days for the hearing, and as it was an extremely heavy patent action it could not be finished before the Courts rose. He suggested that it should be fixed for the 22nd. If that was not suitable there were two judges who were looking for work, and it might possibly come before them.

His Lordship said he would mention it to Mr. Justice Warrington if the parties wished.

Eventually his Lordship fixed the hearing for not before the 22nd inst., to be mentioned 10 days before that date.

British Insulated and Helsby Cables, Ltd., *v.* Crittall Manufacturing Co., Ltd.

On Monday, in the Official Referee's Court, Mr. Muir Mackenzie commenced the hearing of this action for the recovery of £544, the price of an electric welding machine, &c. The hearing was adjourned. We shall report the case next week.

Hamilton *v.* Marconi's Wireless Telegraph Co, Ltd.

This case was to come on in the King's Bench Division on Wednesday.

BUSINESS NOTES.

Competing with the Enemy.—The staff and heads of departments of the Efandem Co., Ltd., Fallings Park, Wolverhampton, dined together at the Victoria Hotel last Friday evening, under the presidency of Mr. W. J. Fahn (director), who, in replying to a toast, referred to some of the effects of the War upon the business of the company as electrical and mechanical engineers and manufacturers. He explained how in 1911, from a small experimental business in Birmingham, they decided to erect works in Wolverhampton, and carried on the manufacture of goods which were never before made in this country. They had to compete with Continental firms, and were fairly successful from the start. Orders from the first were in excess of the output, and for three years the history of the company was one of rapid development. In 1912 they had nearly doubled their buildings and plant, and in 1914 they had a capacity for production which was more important than that possessed by any other single manufacturer in the world; that was to say in two particular lines—for portable electricity and electric car-lighting sets and motor self-starters. Then the War broke out. A great deal of their raw material came from abroad, and material obtained from our present greatest enemies could not be obtained. They were consequently faced by a terrible situation. Fortunately, they had enough raw material stocked to tide them over until new countries of supply could be found. But the price of raw material went up, and the cost of transportation from the United States went up every month. Although they had a large production in portable electricity, it was impossible to supply the demand. As regarded the future, the prospects were absolutely secure. Manufacturers were getting busy in pleasure motor-cars, and though the electrical trade for them had been rather upset, it seemed that in the next few months it was going to rapidly increase.

Great London Fair.—Both the Agricultural Hall and Olympia have been engaged for a London Fair and Market on a gigantic scale in March, 1916. Among the various sections will be those relating to hardware in every branch, lighting, heating and cooking appliances, and electrical apparatus. Each hall will have its complete sections, and a fleet of motor-cars will be employed to convey visitors from one hall to the other. The organisers are the International Trade Exhibitions, Ltd., Broad Street House, London, E.C.

Swiss Information Office.—An office has been opened at Zürich for the economic development of Switzerland; it is controlled and financed by the Exhibitions Department of the Swiss Government, and is intended to furnish information free of cost to all who desire to purchase Swiss products, or to sell their wares in Switzerland. Inquiries on trade matters should be addressed to the Secrétariat Général, Bureau Suisse de Renseignements pour l'Achat et la Vente de Marchandises, Metropol, Börsenstrasse 10, I. Etage, Zürich, Switzerland.

Catalogues and Lists. — From Messrs. Alfred Graham & Co, of St. Andrew's Works, Crofton Park, London, S.E., we have received one of their useful desk blotting pads with daily diary for 1915 at left hand. The firm's patent loud-speaking Naval telephones, also telephones for military, mercantile marine, mining, and other service, are well kept before the mind of the user of the pad.

Messrs. Graham have also sent us a copy of their useful little annual pocket-book of tide and speed tables for 1915. Shipping departments doubtless find it of considerable service.

The Sloan Electrical Co., Ltd, 12, Golden Lane, London, E.C.—18-page illustrated pamphlet giving particulars and prices of "S.L." weatherproof and watertight lanterns for half-watt lamps, also bulkhead fittings, hand lamps, and English china fittings.

British Thomson-Houston Co., Ltd., Rugby.—Four new publications, arranged and illustrated in their standard form and style, as follows:—No. 2,256 (24 pp.) type D R, continuous-current motors; No. 2,216 (8 pp.) type D R, continuous-current generators; No. 5,801 (4 pp.) A.C. brake magnets, two-phase and three-phase, 25 to 50 cycles, for up to 600 volts; No. 4,503 (8 pp.) lightning arresters for A.C. circuits—multi-gap type with graded shunt resistance. Prices are given in most cases.

Electric Suction Cleaner Co., 56, Victoria Street, Westminster, S.W.—A folder card which on the outside asks: "Who's the Lady"? tells inside that she is one who owns a Frant Premier electric suction cleaner, and says ——.

Shopkeepers and others who, under war conditions, are required to shield their window and showroom lights will find some cardboard lanterns which are being distributed by the Edison & Swan United Electric Light Co., Ltd., Ponder's End, very serviceable.

Book Notices.—*The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c., for* 1915. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 15s.—This is the twenty-second year of publication of a work which has established itself in public favour, and the volume consists of 1,800 pages, with 35 sections, several of which have been practically re-written. Amongst the latter are "Power Transmission," "Steam," and "Ball and Roller Bearings," the last-named by Prof. John Goodman. All the other sections have been revised by the specialists who take charge of them, and whose names form an imposing list. By special permission, the Editor has been able to include a number of official regulations, specifications, &c. So familiar a work needs no recommendation.

The *Magazine* of the Finsbury Technical College and Old Students' Association for January contains a portrait of the president, Mr. John E. Raworth, a note on "Phase-Advancers," by J. K. Catterson-Smith, and articles on "Active Service with the London Electrical Engineers," by J. F. Perrin; "Humphrey Pumps," by J. G. Bulger; and "The Diseases of a Field Force," by R. F. Easton. There is also a Roll of Honour of past students.

"Colliery and Mining Machinery (*Bulletin* No. 7)." Part I. London: General Electric Co., Ltd.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 243. March 1st, 1915. This issue contains papers on "Conditions Affecting the Variations in Strength of Wireless Signals," by Prof. E. W. Marchant; "How a Top Stands Up," by J. Swinburne; and "Representation of the Magnetisation Losses in Iron," by N. W. McLachlan; also a "Third List" of 70 members of the Institution who are serving with the Colours.

"Science Abstracts." Sections A and B. Vol. XVIII, Part 2. February 25th, 1915. London: E. & F. N. Spon. Price 1s. 6d. each net.

Trade Announcements.—Owing to increased business Messrs. G. E. Taylor & Co. have taken larger premises, at 7, Suffolk Lane, Cannon Street, E.C., and all communications should now be addressed there.

The address of Messrs. Creed, Bille & Co., Ltd., is now Telegraph Works, Croydon. Rapid business developments having rendered larger works necessary, the Skating Rink, a large and central building adjoining East Croydon Station was secured, and it has been specially adapted for the firm's work. Adjoining land suitable for further extensions has also been acquired.

Messrs. Pitters Ventilating and Engineering Co., Ltd., has removed its offices to the works—33, Nightingale Vale, Woolwich, S.E.—and all communications should be addressed there. New telephone number: Woolwich 427.

The Dussek Bitumen Co. has changed its address to its additional works—Empress Wharf, Sherman Street, Bromley-by-Bow, E.—and all correspondence should be sent there, though certain of the company's products will still be made at the Deptford works.

Mr. H. Wittusen, whose dissolution of partnership we announced several weeks ago, is continuing to trade as Harry Wittusen & Co., at 24, Thavies Inn, Holborn Circus, E.C.

Bankruptcy Proceedings. — G. J. T. J. Parfitt, consulting electrical engineer, Keynsham, Bristol.—First meeting, March 10th, at 26, Baldwin Street, Bristol. Public examination, April 16th, at the Guildhall, Bristol.

G. Burgess (Granville Burgess & Co.), electrical engineer, 27, Museum Chambers, Bury Street, W.C.—Last day for proofs for dividend, March 17th. Trustee, Mr. E. L. Hough, Official Receiver, Carey Street, W.C.

New Zealand.—A Christchurch firm wants to represent a British firm making electric self-starting sets for marine use, which must retail at £10 or less. Apply to H.M. Trade Commissioner, P.O. Box 369, Wellington.

Russian Equivalent Tables.—The Central Translations Institute, Ltd., of 265, Strand, London, W.C., have compiled from official sources a set of Russian equivalent tables, and have issued it at the price of 1s. net. In view of the increasing importance of trade with Russia the issue of such information regarding the somewhat complicated Russian weights and measures, and especially of equivalent tables permitting of instant conversion of British weights, measures and money into Russian, and *vice versâ*, should be of interest to the trading community. The tables cover all ordinary commercial requirements.

Liquidations.—Apparatus and Accessories, Ltd.—Mr. G. E. Corfield, the Receiver and liquidator, reports that, as a result of the satisfactory realisation of the assets of the company, he has collected sufficient funds to provide an immediate distribution of the balance required to make up the agreed composition of 10s. in the £. In addition to the first distribution of 2s. 6d. already paid, a further 7s. 6d. in the £ is now being paid.

Dettifoss Power Co., Ltd.—A meeting will be held at Winchester House, E.C., on April 15th, to hear an account of the winding up from the liquidator, Mr. H. A. McMahon.

For Sale.—Battersea electricity department have for disposal a travelling dock elevator track, and horizontal travelling conveyor. Stockport Corporation has for sale one 720-B.H.P. triple-expansion Belliss & Morcom high-speed engine. Particulars are given in our advertisement pages to-day.

A Siemens Dance.—A dance was held at Mozart House, Albion Road, N.E., on Friday, February 26th, for members of the Siemens Dalston staff and friends. Owing to the war fewer social events have been arranged, and as in previous years it had been customary to hold three dances during the winter session it was felt that just one evening's jollification could not be denied. A company of about 70 assembled. Mr. Dennison acted as hon. M.C., and the arrangements were in the hands of the following Committee:—Miss Moloney, Miss Topper, Mr. Dennison, and Mr. Pryor (hon. sec.).

Italy.—An agent in Florence wants to represent a British firm of manufacturers of electrical appliances. Apply Board of Trade C.I. Department in London.

LIGHTING and POWER NOTES.

Aberdeen.—The Corporation Electricity Committee is to renew the agreement for the lighting of Culter on the terms suggested by the engineer. The consumption of electricity in the city in January was 1,250,610 units, an increase of 67,332 units compared with the same month last year.

Audenshaw.—The U.D.C. has decided to oppose the Stalybridge Joint Board's Electricity Bill.

Barrow.—The T.C. on Monday agreed to the electrical engineer extending the extra high-tension ring main at an estimated cost of £2,242.

Beeleek (Co. Fermanagh).—Public Lighting.—The L.G.B. has sanctioned the application of the R.D.C. for powers to enable it to carry out the public lighting of the town by electricity.

Belfast. — Power Station Extensions. — The City Council has decided not to proceed with the extension of the power station at present. It was stated that in three years, the contribution from the tramways to the rates had fallen from £23,000 to £3,000.

Brighton.—Restricted Lighting.—The Estimates sub-Committee of the Lighting Committee, reporting on the next year's estimates, recommends that the item for electricity supply for street lighting be reduced from £7,500 to £3,650, and for gas from £1,100 to £550, on the assumption that only one-half of the normal supply of electricity and gas will be used owing to restricted lighting. There will be a reduction of £500 in the item for trimming the lamps, owing to metallic-filament lamps being substituted for the arc lamps; and the estimated total saving on public lighting is £5,000. The Committee points out that the reduction in the amount of energy consumed for public lighting during the next financial year will result in a decrease in revenue to the electricity department of £4,450, and the engineer estimates that there will be a net loss of £2,500, assuming the price of current remains at 1¼d. per unit. The Finance Committee states that any deficit will be defrayed out of the reserve fund.

Bristol.—Proposed Bulk Supply.—The T.C. has applied to the B. of T. for an order authorising it to supply current in bulk to the Clevedon, Portishead and District Electric Supply Co., Ltd.

Burnley.—Rate Relief.—The electricity department estimates the surplus for the relief of rates for the current year ending March, at £5,247.

Ceylon.—The Government has granted permission to Messrs. Walker, Sons & Co. to prepare a scheme for lighting the municipality of Ootacamund by the generation of power from the outflow of the St. Lawrence lake. The municipality proposes to borrow Rs.1 lakh to carry out the scheme.—*Ceylon Observer.*

Continental.—Turkey.—It is reported that the stores of coal at Constantinople are becoming exhausted, and that the manufacture of gas and electricity will shortly be impossible.

Coventry.—Lighting Artisans' Dwellings.—The City Council has decided that the rate for the supply of light in artisans' dwellings erected by the Corporation should be for a house containing three lamps 7½d. per week; four lamps, 9d., the charges to include the provision and maintenance of lamps. One meter will be provided to a block of houses to check consumption.

Croydon.—New Boilers, &c.—The Electricity Committee has had under consideration a report of the electrical engineer upon the boiler plant at the works, and recommends the disposal of two of the five remaining obsolete boilers, and the installation of one of a normal capacity of 35,000 lb. of steam per hour, a mechanical stoker, superheater, economiser and chimney. This will effect a saving of about £600 a year.

The electricity department has allowed the Lighting Committee £615 in respect of lamps not lighted during the past quarter. Owing to the serious depletion of the engineering staff at the works, it has been decided not to make any allowances to any further members of this section of the staff who enlist without first obtaining sanction.

Cuckfield.—Prov. Order.—At a meeting of the R.D.C. on February 26th, it was reported that the B. of T. had written, stating that after careful consideration it had decided to defer the question of revoking the prov. order of the Mid-Sussex E.L. Co. for a year.

Dover.—Proposed Loan.—A loan of £6,000 for the provision of additional plant at the electricity works is recommended by the Electricity Committee.

Dublin.—The Corporation has adjourned for a month, pending the year's estimates being submitted, the proposal to increase the electricity rates owing to the increased cost of coal. It was stated that the consumers numbered this year 7,055. The number of units sold to private consumers had increased to 8,300,000. The income for the year was £97,000. The city treasurer estimated that this year the Corporation would have to pay in capital charges £53,650.

Dundee.—Pumping Plant.—The Corporation Electricity Committee is to put down a new pumping station in the neighbourhood of the Eastern Wharf, for the Carolina Port generating station.

East and West Ardsley.—Upon a report by the E.L. Committee as to the carrying out of the E.L. order, the U.D.C. has decided to ascertain the cost of having the order varied by the B. of T.

Eccles.—The Corporation has decided to discontinue the supply of electricity by prepayment meters to Corporation dwellings. In lieu thereof tenants are to be offered a supply either on the flat rate of 4d. in force, or a charge at the rate of 6d. per lamp per week.

Ely.—Prov. Order.—The Gas and Electricity Co., which is applying for a prov. order for electric supply, has asked the B. of T. to dispense with the consent of the U.D.C. to the application. The U.D.C. has decided to reply that the Gas Co. under the proposed order was not compelled to supply current in the whole of the district; that the compulsory area did not include Cambridge Road, one of the principal residential thoroughfares in the town; and that the Council objected to both kinds of lighting being in the hands of one company.

Enniskillen.— Street Lighting.—The R.D.C. is applying for powers to enable it to enter into an arrangement with the Tempo Electric Supply Co., Ltd., for the lighting of the streets of Tempo with electricity.

Finchley.—A new oil engine, similar to that erected in 1913, is to be installed at the electricity works.

Frinton-on-Sea.—The Frinton and District E.L. Co., as the result of an appeal, has secured a reduction in rateable value from £280 to £120.

Glasgow.—Arc Lighting; Electric Cranes.—Owing to the shortage and high price of carbons for the ordinary arc lamps in use at Glasgow Harbour, the Clyde Navigation Trustees have approved of the gradual substitution of flame arc lamps in place of those now in use, as supplies of carbon for these could be obtained without difficulty. It is not intended to deal with Rothesay Dock at present, the arc lamps there being modern.

The Trustees have also approved of a scheme for the gradual replacement of the four hydraulic cranes and the steam crane at the coaling quay in Queen's Dock, by three electric cranes. The first, which is a 32-ton electric, is expected to be in use about June. Arrangements are to be made to procure a second electric crane, and, for the third crane, to remove the present 25-ton steam crane, and to procure a number of electric capstans, and a set of electrically-driven pumps for the swing bridge, all at an estimated additional cost of £20,000, which would be spread over the next two or three years.

The T.C.'s lighting department has installed as an experiment a number of 3,000-c.p. flame arc lamps in points in the busier thoroughfares.

Gloucester.—The Electricity and Light Railways Committee reports that the output in the electricity department for January was 156,606 units, an increase of 2,300 units as compared with the corresponding month last year. For the Light Railway section the output was 43,193 units, an increase of over 2,000 units.

Gortin (Co. Tyrone).—E.L. Scheme.—An electric lighting scheme for the village is being considered, the motive power to be supplied by the Creamery or from the river. A Committee has been formed, and the shareholders of the Creamery are to be approached in the matter.

Grimsby.—Proposed Loans.—The Public Lighting Committee is again recommending the T.C. to approve the proposed battery scheme at the electricity works, and to apply for sanction to borrow £11,000 made up as follows:—Peak load battery, £5,000; prospective expenditure on mains, £4,000; prospective expenditure on services, £2,000.

Halifax.—Proposed Loan.—The Tramways Committee has decided to make application to the L.G.B. for sanction to the borrowing by the Corporation of the sum of £5,000, for prospective expenditure on new electricity mains.

Heston and Isleworth.—The contractors have informed the Electricity Committee that as the colliery from which the coal was drawn had restricted its output, the firm could not give more than 60 per cent. of the quantity contracted for. Under the circumstances, the contractors have been advised that unless coal is delivered to the extent guaranteed in the contract, the Council would buy against them. At the time of writing 200 tons had been ordered from another firm.

Heywood.—Restricted Lighting.—All lights are to be lowered from one hour after sunset to one hour before sunrise as from March 1st.

Hull.—Plant Extensions.—The Electricity Committee has approved of a scheme of plant extension at an estimated cost of £41,500. The scheme provides for the installation of two new boilers, a new turbine of a capacity of 5,000 KW., coal-handling apparatus, water-cooling system, &c.

Kingston-on-Thames. — Proposed Loans. — The Lighting Committee proposes to borrow £16,792 for the purposes of the electricity undertaking, viz., £5,792 in respect of excess expenditure on loans already sanctioned, and £11,000 to meet the estimated requirements for the next four years.

Kingstown.—Mr. Justice Barton, in the Irish Chancery Division, has made an order of the Court the submission and award of Mr. S. L. Brown, K.C., in the matter of the arbitration between the Dublin Southern District Electric Supply Co., Ltd., and the Kingstown Urban Council as to terms of payment for the undertaking; and costs of the company were referred for taxation. The sum of £3,608 is payable to the Electric Supply Co. under the award, as mentioned in our last issue.

Leeds.—Proposed Loans.—The Corporation Finance and Parliamentary Committee recommends to the City Council to apply to the L.G.B. for sanction to borrow £25,000 for a new 6,000-KW. turbo-alternator, with accessories, and £8,700 for a 3,000-KW. turbo-alternator for Crown Point power station. An expenditure of £242,000 is estimated for by the City Tramways and Electricity Committee on electricity undertakings, and it is recommended that application be made to the L.G.B. for sanction to borrow £150,000 for mains extensions and £30,000 for the building and equipment of transformer sub-stations. The Tramways and Electricity Committee estimates the expenditure on tramways capital account for the next financial year at £93,291.

Leyton.—Linking-up Proposals.—The Electric Lighting Committee has under consideration an inquiry from the Hackney B.C. as to whether the District Council would be prepared to consider linking up its works to those of the B.C., so as to take a standby or bulk supply as an alternative to laying down further plant.

Liverpool.—Street Lighting.—Mr. A. G. Smith, the lighting engineer of the city, in his report, states that the lighting by metallic-filament lamps along the whole of the New Broad Green tram-route, as far as the city boundary, is now proceeding, 43 50-C P. lamps having been fixed on side tramway-poles. Of the 501¾ miles of roads lighted at the end of the year, 8¾ were lighted by electricity.

London.—Poplar.—Application is to be made to the L.C.C. for sanction to a loan of £10,188 in respect of the electricity undertaking. The Electricity Committee reports the necessity of erecting an additional sub-station at Blackwall to meet increasing demands; meanwhile the engineer suggests the provision, temporarily, of a further 1,000-KW. converter at the generating station for next winter's load. The estimated cost, with temporary foundations, and machine connections, new switchgear, and rearrangements of switchboard, is £3,350. It is also proposed that a 1,000-KW. converter be installed in the northern sub-station to compete with increased demands in this area, at a similar cost to that proposed for the main station. In connection with this extension it will be necessary to lay two low-tension feeders, and extend the existing feeder in Dace Road, at an estimated cost of £3,688.

Bethnal Green.—The Electricity Committee of the B.C. has approved the following scale of charges for electricity. For lighting purposes:—A (1) Minimum guarantee per half-year, as per Clause 9; (2) rate per unit for 30 hours' use of the maximum demand, per month, 8d.; (3) rate per unit for all further consumption in each month, 1d. B (1) £12; (2) 7d.; (3) 1d. C (1) £60; (2) 6d.; (3) 1d. For power, heating, cooking, and all purpurposes other than lighting:—D (1) As per Clause 9; (2) 3½d.; (3) ½d. E (1) £60; (2) 3d.; (3) ½d. For restricted supplies:—F (1) £3; (2) and (3) 1d. for all consumption.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of the following loans:—£15,000 by the Stepney B.C. for mains, and £500 by the Islington B.C. in respect of the additional cost of cooling towers owing to the effect of war conditions upon the price of materials, especially timber.

Stepney.—The B.C. is recommended to apply to the L.C.C. for a loan of £35,000 for the electricity undertaking.

St. Marylebone.—The Electricity Committee recommends that the present domestic tariff be revised, and that an annual charge (the same as existing) plus ¾d. per unit for current and hire of apparatus be made, subject to the consumer entering into a satisfactory agreement specifying a minimum consumption.

St. Pancras.—The Electricity Committee recommends that the offer of the Ecclesiastical Commissioners to advance £22,530 on loan for boilers for the electricity undertaking be accepted. The B.C. has agreed to give a supply up to 1,000 KW. to the L.C.C. Arlington Road sub-station during the ensuing summer at ¾d. per unit, subject to variation according to the cost of coal.

London Electricity Supply Bill.—The Parliamentary Committee of the Middlesex C.C. proposes to obtain expert advice as to how the proposals in the Bill will affect the county, and generally as to the present electricity supply of the County of Middlesex, and how it could best be organised with advantage.

Macclesfield.—School Lighting.—The Electricity Co. has informed the Borough Education Committee that the directors had agreed to lay a cable to the school clinic free of charge, and without any obligation on the Committee's part as to guaranteed consumption of current, provided that the whole of the premises were wired, and electricity used exclusively as an illuminant. The Committee has replied that it is prepared to wire the premises, but cannot agree to the exclusive use of electricity.

Maidstone.—Proposed Loan.—The T.C. has applied for a loan of £7,450 for the provision of a 1,250-KW. turbo-alternator, foundations and girders, pipework, &c.

Manchester.—Loan Sanction.—The Corporation has received sanction to borrow £20,000, repayable within 15 years, for the purposes of the electricity undertaking.

Newcastle West (Ireland).—The electric lighting scheme has been inaugurated, and is now available for the public light of the town. The scheme was carried out by Mr. W. Phelan, and a few nights ago St. Ita's Hall in the town was lighted up for the first time with electric light.

Pembroke (Dublin).—Increased Charges.—The U.D.C. is recommended to increase the charge for energy for lighting and heating from 4½d. per unit plus 5 per cent., to 5½d. per unit, and for power from 1½d. to 2d. per unit, consumers of more than 25,000 units to be charged 1¾d. per unit.

Reigate.—Questions as to whether the Diesel oil engines were satisfactory were asked at a meeting of the T.C. last week. Replying, the Mayor said he considered them a good investment; about three or four years ago the coal consumption at the electricity works was not much less than 1,500 tons. It was estimated that they would probably require 425 tons this year.

Stockton Heath.—Prov. Order.—The Runcorn R.D.C. has received from the B. of T. a communication relative to a request from the Warrington Corporation that in view of the objections in connection with its application for a provisional order to include in its electric lighting area certain districts in the rural district, the Council's consent be dispensed with. A meeting is to be held shortly to discuss the matter.

Stoke-on-Trent.—Electro-Chemical Supply.—The B.C. has decided on the recommendations of the Electricity Committee to give a supply of electrical energy for electro-chemical purposes to Messrs. Keeling & Walker, commencing with 3,000 units per week, taken continuously over 132 hours weekly, at extra-high-pressure three-phase, at a flat rate of ½d. per unit, subject to an agreement being entered into. It is understood that while one furnace will be started initially, three are to be in use in a year, and the factory is designed for 12 furnaces.

The electrical engineer reports for the six months from April to September, 1914, that the total works costs were £9,614, as compared with £11,152, a reduction of £1,538 in generating costs. The revenue was £22,119, as compared with £21,024, an increase of £1,095. The number of units sold was 3,122,220, as against 2,993,969; cost per unit generated ·511d., as against ·707d.; cost per unit sold ·739d., as against ·894d. Coal per unit sold 5·50 lb., as against 7·79 lb. It was decided to request the B. of T. to approve a system of supply for all extensions where new A.C. mains are laid from the power house, at 415 volts per phase for power, and with 240 volts between each phase and neutral for lighting.

Thurmaston.—E.L. Scheme.—The U.D.C. has decided to obtain expert advice as to the probable cost of an E.L. installation for the town.

Warrington.—Rate Relief.—It is proposed to contribute £1,000 from the electricity undertaking and £2,000 from the tramway undertaking towards the relief of the rates.

TRAMWAY and RAILWAY NOTES.

Blackburn.—The local Society of Tramway Workers has made an application for an all-round increase of 1d. per hour in wages to meet the additional expense incurred through the higher cost of living.

Bolton.—Owing to the increased cost of living consequent upon the war, the workers in the tramway and other departments of the Corporation have applied for an increase of wages. The tramwaymen asked for 1d. per hour rise, and the matter has been referred to the T.C.

Bury.—Lieut.-Col. Druitt, B. of T. Inspector, has passed the tramway extensions at Bury to Jericho and Walmersley, and the routes have now been opened for public use.

Continental.—Italy.—Application has been made for a concession for the construction and working of an electric tramway between Turin, Sassi and Superga, the existing funicular railway between Sassi and Superga being inadequate to the traffic requirements of the localities named, and its concession, moreover, expiring on December 31st, 1916.

Spain.—A concession has lately been granted for the construction and working of an electric tramway between Ferrol and Santa Maria de Nera.

Croydon.—New Tramways.—The T.C. has received the B. of T.'s sanction to a loan of £900 for the construction of a double line of tramway in Cherry Orchard Road. The total outlay will be £1,480, and the balance, representing the outstanding debt on works to be superseded, is to be paid out of the renewals fund.

Dublin.—Petrol-Electric Cars.—The Blessington Steam Tramway Co. has ordered two petrol-electric cars for the summer traffic.

Halifax.—Tramway Extensions.—A deputation from the Southowram U.D.C. reported to the Tramways Committee that it was not satisfied with the terms offered by the Committee for extending the existing tramway, and suggested that the guarantee should be £20 per annum for the first five years, £10 per annum for the second five years, and £5 per annum thereafter, provided that when the whole line paid from the centre of the town to the terminus, as extended, the liability of the U.D.C. for any further payments should cease. The Tramways Committee decided that it could not modify its previous decision on the matter.

Ilford.—Electric Vehicle.—The Electricity Committee has decided to purchase a 4-ton electric battery road van, with automatic tipping gear. The van is for use between the railway siding and the works.

London.—The L.C.C. Finance Committee has decided that war allowances to tramway employés, estimated at £81,000, shall be charged to the tramways account; the Highways Committee reports that despite the improved tramway results this procedure will lead to a deficit on the year, which will further deplete the general reserve fund, which was drawn on to meet the loss on last year's working.

At the last meeting of the Council a motion to refer back this decision, the contention being that such expenditure should be met by a special vote, was lost.

Northampton.—It is estimated that the balance to the credit of the tramways undertaking for the year ending March 31st next will be £1,171.

North London Railway Electrification.—At the annual general meeting of the company, Lord Rathmore stated that there was every reason to hope that electric trains would be running between Broad Street and Richmond over the Hampstead Junction line by the end of the year; the anticipated completion of the electrification of the North London and North-Western local lines this spring had been hindered by the war.

North-Western Electrification.—At the general meeting of the company on February 26th the chairman stated that, including £249,716 advanced to the London Electric Railway Co. in connection with the Paddington—Queen's Park extension, the capital expenditure for the year had been £1,233,250, of which £527,752 was in connection with the Euston—Watford electrification. During the current year it is estimated that £1,800,000 will be spent, the greater part in connection with the new electric railway.

The engineer's report mentioned that the new line between Queen's Park and Willesden was approaching completion. The new power station and repair shed at Stonebridge Park are well advanced and the six sub-station buildings nearly completed.

Southport.—In response to an application by the Tramways Committee for a reduction in the price of energy, the Electricity Committee has stated that alterations to be made at Crowlands will, no doubt, result in a saving of coal, and the Committee will be prepared to consider the application when the alterations are completed.

It is understood that the Corporation tramway workers are about to ask for an advance of 4s. per week in wages, to meet the increased cost of living.

South-Western Railway Electrification.—The yearly report of this company states that the electrification of the company's suburban lines has made steady progress during the past year. The main power house at Wimbledon and the sub-stations at other places are practically completed, and the machinery is being erected. Several of the new electric trains have been constructed and the remainder are being proceeded with. Good progress has also been made with the placing of conductor rails, the bonding of track rails and the laying of high-tension cables on the first section of the railway to be electrified, *i.e.*, the lines from Waterloo to Kingston *via* Twickenham and *via* Malden. Capital expenditure during the year has included £153,303 on electrification of suburban lines and £169,221 on electric power stations, &c.

Uruguay.—The *Diario Oficial* publishes a law authorising the Executive Power to make arrangements for the transfer to the State of the Ferrocarril y Tranvia del Norte. Within a year of the nationalisation of this system, the new directorate of the line will present to the Executive Power a scheme for the electrification and extension of the tramway, which undertaking must be completed within three years.—*Board of Trade Gazette.*

Warrenpoint.—Electrification Scheme.—A project is being promoted by a Belfast company to secure the interest of the directors in the Warrenpoint and Roskern Tramway Co., and to introduce an electrical system. The line had always been worked by horses. Quite recently it closed down.

TELEGRAPH and TELEPHONE NOTES.

Illicit Wireless Apparatus.—At Newcastle-on-Tyne Police Court on the 2nd inst., R. H. Barnett, of 25, Dean Street, Newcastle, was charged with having in his possession, without written permission of the Postmaster-General, component parts of apparatus for sending and receiving messages by wireless telegraphy. Defendant pleaded guilty.

It was shown in evidence that Barnett was a retail dealer, who had in his shop window, and exposed for sale, a wireless spark coil. The proceedings were taken at the express request of the military authorities, who desired that attention should be specially directed to the necessity for a person who had anything to do with wireless apparatus to have a licence. None of the parts had been sold since the war began.

The Court, although convinced of the *bona fides* of Barnett, fined him £10 and costs.

Imperial Wireless Chain.—Whilst stating in the House of Commons that a considerable amount of work had been carried out in connection with the English and Egyptian stations, the Postmaster-General added that the question of proceeding further with the construction of the Imperial wireless chain was under consideration, in view of the altered situation arising from the war.—*Times.*

International Telegraphic Conference.—The Conference, which was to have been held at Paris this spring, has been postponed.

Telegrams in Code.—The Postmaster-General has authorised the use of Broomhall's Imperial Combination Code in communication with all South American countries except Brazil and Dutch and French Guiana. This is in addition to the A B C (5th ed.), Scott's (10th ed.), Western Union, Lieber's, and Bentley's codes.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Belfast.—March 15th. Twelve months' supply of stores for the Tramways and Electricity Committees. See "Official Notices" February 19th.

Birkenhead.—March 9th. Corporation. Continuous-current meters and house-service fuse boxes. See "Official Notices" February 26th.

Burnley.—March 22nd. Electricians' work for the B. of G. Forms, &c., from Mr. J. S. Horn, Clerk, Union Offices.

Bury.—March 8th. Constructional steelwork in connection with the electricity generating station extension. Mr. J. Ainsworth Settle, Borough Engineer, Bank Street.

Dover.—March 9th. Electrical sundries and cables for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street.

Dundalk.—March 23rd. U.D.C. Twelve months' supply of stores for the Electricity Department. See "Official Notices" to-day.

Edmonton.—March 10th. Electric lamps for the B. of G. Mr. F. Shelton, Clerk, The Grange, White Hart Lane, Tottenham.

Grimsby.—March 8th. Corporation. Two years' supply of motor-type meters. See "Official Notices" February 26th.

Heston and Isleworth.—March 6th. U.D.C. Twelve months' supply of electrical stores. See "Official Notices" February 26th.

Hove.—March 26th. Corporation. One 500-kw. mixed-pressure steam turbine, complete with D.C. 230/285-volt generator and surface condensing plant; also a battery of 115 accumulators. See "Official Notices" to-day.

Ilford.—March 9th. U.D.C. Supply and delivery of electric coal-wagon. Mr. A. H. Shaw, Electricity Works.

Italy.—Telephone and electric lighting material, telephone wires and motor plant, for a firm at Palermo. Write to Secretary, British Chamber of Commerce for Italy, 1. Via Innocenzo, Frugoni, Genoa, quoting Board of Trade reference, No. 514.

Kirkcaldy.—March 22nd. Corporation. Twelve months' supply of brass castings, pitch, iron castings, &c., for the Electricity and Tramways Committee. Forms of tender from Mr. O. F. Francis, Burgh Electrical Engineer.

Liverpool.—March 12th. Electrical fittings for a year for the Select Vestry. Mr. G. W. Coster, Clerk, Brownlow Hill.

London.—L.C.C.—March 16th. Reconstruction of three miles of single-line tramway on the underground conduit system. Specifications, &c. (£5), from Chief Engineer, County Hall, Spring Gardens, S.W.

Hornsey.—March 16th. Meters, cables and stores, &c., for the T.C. See "Official Notices" February 19th.

Bow.—March 9th. Electrical supplies, for the Managers of the Poplar and Stepney Sick Asylum District. Forms of tender from the Clerk, Devons Road, Bow, E.

Wandsworth.—March 15th. B. of G. One month's supply of electrical fittings, for the Wandsworth Union. Forms of tender from the Clerk, Union Offices, St. John's Hill, S.W.

Londonderry.—March 13th. Corporation. Engine-room stores, carbons, meters, bitumen, fuse-boxes. Forms of tender from the Electrical Engineer, Electricity Department.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Mr. Wm. Tingay, Clerk.

Manchester.—March 9th. (*a*) One 250-KVA. transformer, and (*b*) E.H.T. and L.T. cables. Mr. F. E. Hughes, Secretary, Electricity Department.

March 10th. Three 3-wire balancers for the Electricity Committee. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

Newport (Mon.).—March 15th. Uniform clothing for the Corporation Electricity and Tramways Department. Mr. N. J. Young, General Manager.

Pontypridd.—March 8th. U.D.C. Twelve months' stores for Electric Light and Tramways Department. See "Official Notices" February 19th.

Rochdale.—March 11th. Twelve months' supply of stores for Tramways Department. Mr. G. Webster, General Manager, Tramway Offices, Mellor Street.

Salford.—March 8th. Axles and wheels for 24 bogie cars. General Manager of tramways, 32, Blackfriars Street.

South Shields.—March 12th. Twelve months' supply of engine-room stores for the electricity works. Specification from Mr. H. S. Ellis, Borough Electrical Engineer.

Spain.—The Ministerio de la Gobernacion is inviting tenders for the construction of a telephone line between Barcelona and La Junquera, and one from Barcelona to Valencia.—*Board of Trade Journal.*

Swindon.—March 13th. Corporation. Twelve or six months' stores for Electricity and Tramway Departments. See "Official Notices" February 19th.

Swinton and Pendlebury.—March 19th. U.D.C Cables, joint-boxes, bitumen and joint-box compound. See "Official Notices" to-day.

Transvaal.—Bethal. March 25th. Municipality. Supply and erection of generating and pumping plant and overhead electric distribution system. Specifications from the consulting engineer, Mr. H. Hancock. P.O. Box 62, Klerksdorp (deposit £1 1s.).

Warrington.—March 9th. Electrical goods (German or Austrian barred) for the B. of G., for six months. Forms, &c., from Arthur Bottomley, Clerk, Bewsey Chamber.

March 16th. Motors, cables, and E.H.T. feeder panel, for the Electricity Department. See "Official Notices" to-day.

Wigan.—March 16th. Corporation. Supply of stores for the Electric Light Department. See "Official Notices" to-day.

Wrexham.—March 17th. Meters, oils, coal, &c., for the Corporation Electricity Department, for a year. Borough Electrical Engineer, Willow Road.

CLOSED.

Barrow.—The T.C. has placed an order for a 200-KVA. transformer with the British Westinghouse Co., at £125; this was the lowest of three tenders received. The T.C. has adopted the engineer's suggestion that wherever possible, existing contracts for oils and stores should be renewed for 12 months with the same contractors.

Bingley (Yorks).—The U.D.C. has placed a 12 months' contract for the sole supply of single and polyphase balanced load meters with the Electrical Apparatus Co., Ltd.

Birmingham.—The City Council is being asked to sanction the purchase of 2,000 tons of steel rails and fishplates from the Lorain Steel Co., of America.

Blackpool.—The Corporation has accepted the tender of the Davenport Engineering Co., for a new cooling tower at the electricity works.

Bolton.—The Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for switchgear.

Cardiff.—The Building and Sites Committee has accepted the tender of Messrs. H. J. Cash & Co., at £2,400, for the electric installation at the new Technical Institute.

Croydon.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for the following plant at the electricity works:—

Boiler, superheater, and economiser, £4,215; two chain-grate stokers, £920; motor-driven induced-draught plant with iron chimney, £795; indicating steam flow meter, £23.

Dewsbury.—The B. of G. has accepted the tender of Mr. F. Dutton, of Heckmondwike, for electric bell work at the Nurses' Home and Infirmary, at £27 17s. 6d.

Dover.—The Corporation Electricity Committee has accepted the tender of the British Thomson-Houston Co., Ltd., for a 1,000-KW. turbo-alternator set complete with exciter, condenser and pumps, at £4,725.

The Tramways Committee has given an order to Messrs. Dick, Kerr & Co. to supply 50 tons of rails and the necessary fishplates, at £8 15s. and £11 15s. per ton respectively.

Finchley.—The D.C. has decided, should circumstances render it necessary, to buy against the contractors for the supply of 500 tons of coal for the works over a period of three months. The firm, having delivered 93 tons of the quantity arranged, have written stating that they will be unable to deliver any further quantities in the immediate future, but will do so when circumstances permit.

Glasgow.—The Clyde Navigation Trustees have accepted the following tenders for equipment in connection with the new 32-ton electric crane at Queen's Dock:—Cables—Johnson & Phillips, £947; switchboard—Crompton & Co., Ltd., £111; coaling cradle—Sir William G. Armstrong, Whitworth & Co., Ltd., £650; and three weighbridges—W. & T. Avery, £540.

Horsham.—The U.D.C. has placed a contract for D.C. meters with the Electrical Apparatus Co., Ltd., for the year ending March, 1916.

Ilford.—The following tenders have been accepted by the Electricity Committee for supplies of coal for a period of three months:—

E. Foster & Co.—1,000 tons Ibstock medium peas, 19s. 11d. per ton; 500 tons Ibstock D/S nuts, 17s. 5d. per ton; 500 tons ditto slack, 17s. 5d. per ton.
Bradbury, Son & Co., Ltd., Warwickshire (Tamworth).—D/8 nuts, 50 tons per week, 21s. 1d. per ton.

Leyton.—The tender of Messrs. W. Rickard, Ltd., has been accepted by the U.D.C. for a six months' supply of cable at basis prices, ranging from £32 11s. for 3/18 to £101 13s. for 7/14. The tender of the Oliver Arc Lamp, Ltd., has also been accepted for the supply of 22,000 pairs of "Oriflamme" carbons, at £5 7s. 6d. per 1,000 pairs, and 18,000 pairs of "Metroflamme," at £5 15s. per 1,000 pairs.

The present contract for the supply of engine oils to the Electricity Department is to be extended for a further period of 12 months upon the same terms.

London.—Bethnal Green. The B.C. is recommended to accept the tender of Messrs. Measures Bros., at £534, for iron and steel work at two sub-stations.

L.C.C.—It is stated that the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., at £62,003, has been accepted for the supply of two 8,000-KW. turbo-generators at the electricity station at East Greenwich.

St. Pancras.—The B.C. Electricity Committee has received the following tenders for the supply of 250,000 pairs of open-type arc lamp carbons:—

General Electric Co., Ltd. (recommended)	£2,009
Wells Electrical Co.	2,185
Oliver Arc Lamp, Ltd.	2,185
Engineering and Arc Lamp, Ltd.	2,185
British Central Electric Co.	2,490
Wm. Geipel & Co.	2,535
London Commercial Electrical Stores, Ltd.	2,630
The Electrical Supplies Co.	2,830

The engineer, in recommending the acceptance of the above tender, pointed out that the cost of a similar quantity of carbons at last year's price would only have been £871 15s.

St. Marylebone.—The Electricity Committee recommends the acceptance of the tender of Messrs. R. H. Towler, for the supply of a blow-down tank, at £87.

The Committee has accepted the tender of Messrs. T. Press & Co. for renovating the interior of Aybrook Street sub-station, at £34 10s., and of Messrs. Carter & Co. for retiling and renovating the rotary converter room, at £53.

STEPNEY.—The Electricity Committee has received the undermentioned tenders for the supply of 50 tons of moulded pitch:—

T. Crow & Sons (recommended) ..	£1	9	6 per ton
Forbes, Abbott & Lennard, Ltd. ..	1	14	9 ,,
Grindlay & Co., Ltd.	1	17	3 ,,
J. Smart & Son	2	0	0 ,,

The Committee has accepted offers of 1,930 tons of coal for the Electricity Department at prices varying from 15s. 9d. to 21s. 6d. per ton.

BERMONDSEY.—The Electricity Committee has had under consideration tenders for the supply of coal for the period ending June 30th next, but as the increase in price is very considerable, and having regard to the Government statement as to bringing down coal prices, the Committee does not consider it would be advisable to make a contract at the present time. It is therefore proposed to purchase 400 tons of Shipley peas from Messrs. Myers, Rose & Co., Ltd., at 22s. 3d. per ton.

The following tenders have been received by the London Education Committee for installing electric light at the Scawfell Street School, Haggerston :—

Johnson, O'Sullivan & Co. .. .. (recommended)	£313
A. Hawkins & Sons	322
Alpha Manufacturing Co.	344
Lund Bros. & Co.	375
T. N. Kingdon & Co.	397
G. Weston & Sons, Ltd.	415

Luton.—The T.C. has accepted the tender of the Harris Patent Feed Water Filter, Ltd., for a water-softening plant for the refuse destructor, at £129.

Maidstone.—Subject to a loan being granted, the T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for a 1,250-KW. turbo-alternator of the Ljungstrom type, at £6,887.

Manchester.—The Electricity Committee has accepted the following tenders :—

J. Spencer, Ltd.—Low-pressure pipework and valves, Stuart Street Station.
B. I. and Helsby Cables, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.—Cables.

The Gas Committee has approved the Electric Construction Co., Ltd., as sub-contractors for dynamos required in connection with the construction of a retort house.

The Rivers Committee has accepted the tender of Messrs. Glenfield and Kennedy, Ltd., Kilmarnock, for electrically-operated rectangular channel penstocks.

The Tramways Committee has accepted the tender of the B.I. and Helsby Cables, Ltd., for tramway rail bonds, and that of Messrs. Hadfield, Ltd., for steel portable track rails.

North Bierley.—Out of 32 tenders submitted for the supply of 800 lamps to the North Bierley Union Authorities, Bradford, that of Mr. H. Moss has been accepted.

Salford.—The Electricity Committee has accepted offers for the purchase of the undermentioned plant, to be displaced at the Electricity Station, Frederick Road :—

S. Openshaw.—Two reciprocating engine sets, £1,650.
T. Mitchell & Sons, Ltd.—Three continuous current motors, £105.

The tender of Messrs. G. Wragge, Ltd., has been accepted by the Committee, at £104 14s., for steel and glass partitions at the Electricity Station.

Wolverhampton.—The Corporation has placed a contract for the whole of its requirements for A.C. meters with the Electrical Apparatus Co., Ltd., for a year.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturdays, March 6th and 13th. At 3 p.m. At Albemarle Street, W. Lectures III and IV on "Recent Researches on Atoms and Ions," by Sir J. J. Thomson, F.R.S.

Salford Technical and Engineering Association.—Saturday, March 6th. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Strength of Iron Castings," by Mr. E. L. Rhead.

Association of Engineers-in-Charge.—Saturday, March 6th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Debate on "How to Pay for the War," a scheme proposed by the British Engineers' Association.

Wednesday, March 10th. At 8 p.m. Paper on "Modern Steam Laundry Machinery, more Particularly as Applied to Institution Work," by Mr. B. P. Flockton.

Institution of Mechanical Engineers (Graduates' Association).—Monday, March 8th. At 8 p.m. Paper on "Propelling Machinery for Ships," by Mr. W. J. Drummond.

Institution of Civil Engineers.—Tuesday, March 9th. At 8 p.m. At Great George Street, S.W. Paper on "The Improvement of the River Clyde and Harbour of Glasgow, 1873-1914," by Sir T. Mason.

Wireless Society of London.—Tuesday, March 9th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Lecture on "Waves," by Dr. Erskine-Murray.

Royal Society of Arts.—Wednesday, March 10th. At 8 p.m. At John Street, Adelphi, W.C. Paper on "Patent Law Reform and the War," by Mr. J. W. Gordon.

Institution of Electrical Engineers.—Thursday, March 11th. At 8 p.m. At Victoria Embankment, W.C. Paper on "Electric Cooking, mainly from the Consumers' Point of View," by Mr. W. R. Cooper.

(**Yorkshire Local Section**).—Wednesday, March 10th. At 7 p.m. At Philosophical Hall, Leeds. Paper as above, by Mr. W. R. Cooper.

(**Manchester Local Section**).—Tuesday, March 9th. At 7.30 p.m. At Engineers' Club, 17, Albert Square. Paper on "Electricity Applied to Mining," by Mr. C. P. Sparks.

(**Scottish Local Section**).—Tuesday, March 9th. At 8 p.m. At Princes Street Station Hotel, Edinburgh. Paper on "Automatic Protective Switchgear for Alternating-Current Systems," by Mr. E. B. Wedmore.

Institute of Marine Engineers.—Friday, March 12th. At 8 p.m. At Tower Hill, Minories. Annual Meeting.

Physical Society of London.—Friday, March 12th. At 8 p.m. At Imperial College of Science, South Kensington. Papers on "The Estimation of High Temperatures by the Method of Colour Identity," by Messrs. C. C. Paterson and B. P. Dudding; "The Unit of Candle-power in White Light," by Messrs. C. C. Paterson and B. P. Dudding; and "The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (R.M.S.)," by Mr. G. L. Addenbrooke.

South-Western Polytechnic Institute.—Friday, March 12th. At 8 p.m. At Manresa Road, Chelsea, S.W. Presentation of Prizes and Certificates by Mrs. Hayes Fisher.

Greenock Electrical Society.—Saturday, March 13th. Visit Messrs. Mavor and Coulson's Works, Glasgow.

NOTES.

Patents and Alien Enemies.—Mr. C. E. Lugard has been granted licences by the Board of Trade in respect of Patents Nos. 13,067-8-9, of 1906 (Schuster and another).

Educational Notes.—In connection with classes held at 23, Great Quebec Street, Marylebone, W., Mr. K. H. Bird, M.A., now undertakes the preparation of candidates for science and engineering degrees (external students) of the University of London; entrance to the City and Guilds Engineering College, the Finsbury Technical College, &c.; Graduation and Associate Membership of the Institutions of Civil, Mechanical, and Electrical Engineers; factory inspectorships, &c. The engineering department has been organised and is carried on under the personal direction of Mr. G. W. de Tunzelmann, B.Sc., M.I.E.E., consulting engineer, formerly Professor of Physics at the Royal Naval College, Dartmouth, who, as many of our readers will remember, organised, and for some years conducted, one of the best known private engineering schools in England, and is a recognised authority on the education and training of engineering students.

The Ponder's End works of the Edison & Swan United Electric Light Co., Ltd., Middlesex, were visited on Wednesday, the 24th ult., by the members of the Chemical Society of the Royal College of Science, South Kensington, Mr. E. W. Swann, their excursion secretary, being responsible for the arrangements. An interesting tour was made through all the lamp manufacturing departments, including carbon and drawn-wire sections.

Public Lighting in War Time.—The *Illuminating Engineer* states that a Committee of the Illuminating Engineering Society, formed to consider the framing of recommendations on shop-window lighting, so as to enable merchants to comply with the requirements of the authorities, and at the same time to get the best illumination possible in the present circumstances, has prepared a series of recommendations which have been approved by the Council and submitted to the authorities. The Committee has invited the co-operation of several representatives of the Joint Committee formed to prepare the draft standard specification of street lighting, in order to consider what steps can be taken to make a similar study of the "scientific darkening" of the streets.

Trade Statistics of the United States.—An American report just issued quotes some interesting preliminary figures showing the course of trade of the United States during the year 1914. Imports in that year showed a slight decrease as compared with those in 1913, and there was a decrease of about £75,000,000 in exports, the figures for 1914 being roughly £414,000,000, as compared with £489,000,000. While the European war has undoubtedly had a considerable share in causing this reduction, other factors have not been without influence. The largest decreases are to be found in the headings raw materials for manufacturing and manufactures ready for consumption. The following statement of the imports and exports from and to belligerent countries are of interest :—

	Imports from.		Exports to.	
	1913. Dollars.	1914. Dollars.	1913. Dollars.	1914. Dollars.
United Kingdom	271,954,987	278,391,143	590,732,398	599,812,295
France	138,933,833	104,215,131	153,922,526	170,104,041
Belgium ...	41,458,376	30,362,019	64,317,469	34,771,023
Russia	22,322,957	12,306,334	25,965,351	22,260,062
Japan	98,935,957	105,696,252	62,499,819	41,750,979
Germany ...	184,211,352	149,389,366	351,930,541	158,294,986
Austria-Hungary	19,083,392	15,683,880	22,214,599	12,801,195

The effect of the control of trade routes is clearly shown in these figures, but it is a noticeable fact that the exports from America to Italy showed an increase of about 30 per cent., a circumstance from which it is not difficult to draw an inference.

Incorporated Municipal Electrical Association.—The President of the I.M.E.A., Major H. Richardson, having been called up for Service on the outbreak of the war, and being unable, therefore, to discharge for the present the duties of his office, the Council appointed the senior vice-president, Mr. A. C. Cramb, as acting-president during Major Richardson's absence. Later, when it became necessary to consider the question of the 1915 Convention which was to have been held in Dundee, the president expressed a wish that only the necessary business of the Association should be carried on at present, and that the usual Convention should not be held this summer. The Council, after due consideration, decided that instead of the proposed Convention in 1915 in Dundee, business meetings should be held in London for the transaction of routine business necessitated by the articles of association and for the discussion of matters of general interest to the members.

The following is the preliminary outline programme of the arrangements, which (other than dates) are subject to variation.

The meetings will be held at the Institution of Electrical Engineers, Victoria Embankment, W.C., by courtesy of the Council of the Institution, and will be restricted to members and official delegates.

THURSDAY, JUNE 17TH.

10 a.m.—To receive and discuss a report prepared by Mr. A. S. Blackman (chief electrical engineer, Sunderland), and Mr. T. Roles (chief electrical engineer, Bradford), on behalf of the "Point Five" Association, on "The Practical Result of the Point Five Tariff."

2.30 p.m.—To receive and discuss a report prepared by Mr. Frank Ayton (chief electrical engineer, Ipswich), hon. secretary of the Electric Vehicle Committee of the I.M.E.A. on "The Use of Electric Vehicles in Municipal Service."

The meeting will be followed by a parade and demonstration of electric vehicles.

FRIDAY, JUNE 18TH.

10 a.m.—Annual general meeting. To receive the annual report and balance sheet; elect the officers and Council; and transact other business.

2.30 p.m.—If necessary the members will reassemble to complete any adjourned business.

The usual visitors' list will on this occasion be suspended; there will be no social functions, and it is not proposed to invite ladies. The headquarters of the Council will be the Hotel Cecil. The detailed official programme will be issued later. All communications relating to the business meetings should be sent to the secretary, at 28, Bedford Square, London, W.C.

DEVELOPMENT COMMITTEE.

At the second and third meetings of the Development Committee, held at the Institution of Electrical Engineers, on January 15th and February 12th, 1915, respectively, the steps taken with regard to co-opting further members of this Committee were reported upon, and the complete list to date is as follows:—

Representing the I.M.E.A.—

Chairman, S. E. Fedden (Sheffield).

S. T. Allen (Wolverhampton).
F. Ayton (Ipswich).
A. S. Blackman (Sunderland).
R. A. Chattock (Birmingham).
A. C. Cramb (Croydon).
Coun. Crowther (Sheffield).
J. E. Edgcome (Kingston).
Ald. Ellaway (Birmingham).
F. M. Long (Norwich).
H. Richardson (Dundee).
Ald. Pearson (Bristol).
H. F. Proctor (Bristol).
T. Roles (Bradford).
A. H. Seabrook (Marylebone).
Ald. J. Smith (Barrow).
W. A. Vignoles (Grimsby).
G. Wilkinson (Harrogate).

Acting Hon. Sec., J. W. Beauchamp (West Ham).

Representing the A.M.E.E. (Greater London).—

W. C. P. Tapper (Stepney).

Representing the B.E.A.M.A.—

R. J. Ireland (British Thomson-Houston Co.).
G. Maurice (General Electric Co.).
H. C. Siddeley (Lancashire Dynamo Co.).
D. N. Dunlop (Sec. B.E.A.M.A.).

Representing Electrical Contractors' Association.—L. G. Tate (Secretary).

Representing Cable Makers' Association.—L. B. Atkinson (W. T. Glover & Co., Ltd.)

Representing Association of Electrical Power Companies.—W. A. Chamen. A. de Turckheim (Secretary).

Representing British Electrical Federation.—W. L. Madgen.

Representing Society for Electrical Development, U.S.A.—F. W. Wilcox.

Sub-Committees were appointed to deal with the following matters:—

1. Publicity, to be operated from London district. Secretary, A. C. Cramb (Croydon).

2. Electrical Installations, to be operated from the Bradford district. Secretary, T. Roles (Bradford).

3. Domestic Appliances, to be operated from the Birmingham district. Secretary, S. T. Allen (Wolverhampton)

Further particulars in regard to the constitution of these Committees will be given when they are completed.

It was considered advisable to distribute the operations of these Committees over different districts of the country, in order to make it easier for persons who might, by reason of their experience or otherwise, be very useful, to attend the meetings.

It was also decided that Sub-Committees should have the power to co-opt persons, not necessarily members of the Development Committee or of the Incorporated Municipal Electrical Association, who, by reason of their experience in connection with different branches of the electrical industry, might be willing and able to give assistance in the work of the Sub-Committees.

A Rathenau Foundation.—It is announced that the Prussian Ministry has just given approval to the Emil Rathenau Foundation established by Herr Emil Rathenau in conjunction with the directorate and board of supervision of the A.E.G. The object of the Foundation is to place the Physical-Technical Reichsanstalt in the position of being able to promote enterprise in the department of electricity and magnetism by the acquisition and maintenance of distinguished workers and the grant of aid to its members and constant collaborators for undertaking journeys of investigation to similarly equipped institutions in Europe or in transmarine countries, together with the appropriate provision of costly instruments for which State funds cannot be rendered available. The Foundation has been established in honour of the creator of the A.E.G. on his 75th birthday. When it is mentioned that the assets of the Foundation merely consist of obligations or debentures in the A.E.G. for 100,000 marks (£5,000), it will be obvious that the promoters of the scheme have prepared a comprehensive programme for attempted realisation, although the real value of the obligations must have been much greater than the nominal value prior to the outbreak of the War. At the same time, further contributions are looked forward to, as an administrative council composed of the president of the curatorship of the Reichsanstalt, a member of the curatorship and the president of the Anstalt has been appointed to decide upon the use to be made of the available means and of any future additions to the fund.

"Powerful Lights" Defined.—*The Motor* states that "a case was heard at Mortlake recently in which a member of the Automobile Association was summoned for driving with powerful lights. The case was particularly important because it was the first in which the police attempted to define the meaning of 'powerful lights.' The lamps complained of were electric side lamps of 6 C.P. each, and the police stated that the law officers of the Crown had given it as their view that any lamp showing a greater power than that of the ordinary oil lamp carried by taxicabs would be considered a 'powerful light' within the meaning of the Regulation now in force. This definition means that the side lamps, if electric, must be kept down to about 2 C.P. each in order to conform with the present requirements. Motorists must therefore reduce the power of their electric lamps either by using smaller candle-power bulbs or by adequately masking the glasses."

Manchester Tramway Employés' Society.—The Manchester Corporation Tramway Employés' Social and Athletic Society reports that during the past year the membership stood at 2,889, an increase of 300. Of the total members, 780 are now on active service. The society has furnished members in military training at Morecambe with football jerseys and knickers, and 100 packs of playing cards have been sent to soldiers at the Front. The income of the society last year amounted to £1,304, and the expenditure, including depreciation, to £1,196, leaving a profit of £108.

Golf.—At the annual meeting of the Aberdeen Electric Golf Club it was reported that the season so far as it went was satisfactory. The most important competitions, the Campbell Cup and the medal, had to be abandoned, as over 30 members were serving with the Colours. Mr. D. C. Campbell was re-elected captain, Mr. E. F. Stuart secretary and treasurer, and Mr. A. C. Duthie assistant secretary.

Ownership of Italian Water Power.—A curious dispute on the question of the ownership of the Lake of Gherla has arisen between the Società Varesina per Imprese Elettriche and the Domainal authorities. The latter granted to the former water rights in the Magorabbia torrent for the generation of electricity to work the Varese-Gherla-Luino Railway, but, on the ground that a portion of the waters of the Lake, claimed as Domainal property, fall into the torrent, sought to impose a rule limiting the intake of water from both the torrent and the Lake. As the Varesina Society had already paid a private individual who claimed the Lake as private property, for the use of this water, the Domainal claim was resisted, and the matter brought before the Court at Varese, the Ministers of Finance and of Public Works being cited as witnesses. The local Court having dismissed the case on a point of form, the question has been referred to the Corte d'Appello for decision.

German Wireless.—Among the German war news received by Marconi wireless, and published in the *Times* of Saturday last, was a paragraph stating that "the General Electric Co. of Belgium will subscribe five million marks to the new War Loan." There is obviously an error in translation here. The title is practically identical with that of the Belgian branch of the General Electric Co., Ltd., of London, which, of course, knows nothing about the matter—indeed that branch company only has a capital of £10,000. If there be any truth at all in the news, it must relate to one of the German electrical companies operating in Belgium.

Institution and Lecture Notes.—Diesel Engine Users' Association.—At the February meeting of this Association held at the Institution of Electrical Engineers, the President (Mr. J. E. Edgcome) announced that further particulars were being obtained in connection with the question of the use of Mexican fuel oil in Diesel engines, and in connection with specifications for fuel oil, and that both these subjects would be brought up for further discussion at a subsequent meeting. He also announced that at the next meeting the general question of insurance of Diesel engines against breakdown would be further discussed.

The discussion on the breakdown of a Carels Diesel engine at Oxford, which had been reported at a previous meeting, was resumed. Mr. F. H. Francis exhibited a bolt head from the connecting-rod big end of his engine at Oxford, and explained that this bolt was one which had failed at a previous breakdown in May, and not at the breakdown now under discussion. He stated that both bolts were very similar, and that both were obtained from the Consolidated Diesel Engine Manufacturers, Ltd. The second bolt which broke had been tested by the Sheffield Testing Works, Ltd., and they had stated that it was made of good quality iron. Mr. Francis considered that steel would have been more suitable. He then produced a table of figures which he had worked out from particulars supplied to him by various Diesel engine users, and pointed out that Mr. Philip Smith's contention that the bolt was overstressed in the case of the Oxford engine appeared to be correct. It was interesting to note that in the case of the Carels engines at Chelsea and Clacton, which are of the same size as the Carels engine at Letchworth, the big-end bolts are 25 per cent. to 35 per cent. larger in area. Apparently in the case of the Chelsea and Clacton engines the makers had rehammered out the big ends so as to take the largest bolt they could get in without altering the design of the big end.

Mr. Philip H. Smith, who had been invited to attend the meeting, gave data of relative stresses in big-end bolts in the case of engines of various makers. He contended that the bolts of the big end of the connecting-rod were of insufficient strength for their purpose, and that the absence of a proper radius under the head of the bolt was a weak point in the design. In the course of the discussion which followed, he expressed the view that periodic annealing of the connecting-rod bolts was not to be recommended, but he considered that such bolts should not be stressed above 3,000 lb. per sq. in., and that they should be renewed every 12 months or so, or say, after about 3,000 hours' run. He added that in mentioning a definite period for the use of the connecting-rod bolts he was to a great extent guided by information given him by Diesel engine users.

Mr. Everett gave some further particulars concerning the fracture of a gudgeon pin on his Carels engine at Clacton-on-Sea, and Mr. Smith expressed his opinion that this might have been due to the strain caused by a pre-ignition, which was known to have occurred on the engine on one occasion when the fuel cam was not in order.

Mr. H. L. Dixon, of Leatherhead, considered that without some further explanation it would not appear to be advisable that the bolts of the big end should be a tight fit, but that any shearing strain on the bolts should be taken by a spigot, to which Mr. Smith replied that, in his opinion, a tight fit for the bolts was preferable, but that he considered that a jaw-shaped connecting-rod was the best arrangement.

The next meeting is to be held on Wednesday, March 17th, at the Institution of Electrical Engineers. Information and particulars concerning the Association can be obtained from the Acting Hon. Secretary, Mr. Percy Still, of 19, Cadogan Gardens, London, S.W.

Institution of Electrical Engineers.—At the meeting of the Newcastle Local Section on Monday (March 1st), and that of the Birmingham Local Section on Wednesday, Mr. C. P. Sparks read his paper on "Electricity Applied to Mining."

Swedish Electrical Exports.—The exports of electrical machinery from Sweden last year only attained a value of £188,600, as contrasted with £254,250 in 1913. On the other hand, there was an increase in the exports of telephone material and apparatus—from £318,310 to £340,520.

Parliamentary.—*Second Readings.*—In the House of Lords on February 24th, the Aberdare U.D.C. (Tramways, &c.) Bill, and the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board Bill were read a second time.

National Electrical Week.—It is proposed that the National Electrical Week to be organised by the Society for Electrical Development, Inc., of New York, shall take place early in the spring of 1916.

Appointments Vacant.—Shift engineer (37s.), for Dewsbury Corporation; switchboard attendant (30s.), for Stockport electricity department; plumber-jointer (40s.); two sub-station attendants (30s. each); arc lamp trimmer, for borough of Wolverhampton; assistant electrician and fitter (£84), for Leicester Borough Mental Hospital; shaft engineer (42s. to 45s.), for Redditch U.D.C. See our advertisement pages to-day.

Inquiries.—Makers of the Arcazon arc lamps, suppliers of graphite and manganese peroxide in large quantities, and makers of accessories and spare parts for use with the Santoni and Sunshine flame arc lamps are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. H. J. Hazelgrove, draughtsman, was presented with a pair of pictures, as a mark of esteem, by the staff of the Battersea Council's electricity department, on his leaving to take up a more lucrative position with the Sturtevant Engineering Co.

Mr. H. H. Partington, of Falkirk, has been appointed as sub-stations superintendent at the Salford electricity works, at a salary of £200 per annum. This sum has been fixed as the minimum salary for future holders of this position.

Mr. F. Pape, of Barrow-in-Furness, has been appointed as shift engineer at Eccles (in place of Mr. Bedford, who has volunteered for military service).

Mr. George J. Hollyer, A.M.I.E.E., has been promoted by the Walthamstow U.D.C. to the position of assistant electrical engineer. In this capacity he will have entire charge of all departments of the electricity undertaking during the absence of the chief engineer.

Mr. Fred. Tyrrell, assistant electrical engineer at the Ascot works, and formerly of Kingston-on-Thames, has received a similar appointment at Lagos, Nigeria.

Mr. Fred. Duckworth has been appointed head clerk in the Haslingden Corporation electricity and tramways department.

Mr. Alfred L. Lunn, who for the past five years has been one of the charge engineers at the Corporation Works, Sunderland, has been appointed to a similar position under the Manchester Corporation, at the Stuart Street works. He began his new duties on Monday. Before going to Sunderland Mr. Lunn was at Manchester. The Sunderland electricity staff presented him with a case of fish servers and eaters. Mr. Wilfred Yorke, assistant engineer, made the presentation.

Mr. F. P. Evans, who has acted as mains and meter superintendent to the Urban Electric Supply Co., Ltd., Grantham, since December, 1907, severed his connection with the Grantham Works on February 24th. The staff presented him with a set of military hair brushes, a letter case and a fountain pen. He left Grantham to take up the position of chief assistant at Market Drayton.

Under the present circumstances, the Ilford Electricity Committee has adjourned *sine die* the question of the salary of the electrical engineer.

Tramway Officials.—Croydon T.C. has increased the salary of Mr. Gordon Stanley, engineering assistant in the tramways department, from £160 to £185 per annum.

General.—Dr. Archibald Barr, Emeritus Professor of Civil Engineering and Mechanics at Glasgow University, has been honoured by professional bretheren and former students on the occasion of his recent retiral from the professional chair. At a largely-attended meeting in the Bute Hall of the University, one portrait of Dr. Barr was presented to the University and the other offered for Mrs. Barr's acceptance. Mr. J. S. Nicholson, lecturer on Electrical Engineering at Glasgow University, presided, and the presentations were made by Mr. Hugh Reid, LL.D., of the Hyde-park Locomotive Works, Principal Sir Donald MacAlister accepting on behalf of the University authorities.

Mr. Hudson, of Messrs. Hudson, Sheed & Towell, Ltd., has severed his connection with that firm, and has taken up his old position with Messrs. Fredk. Thomas & Co., 189, Drummond Street, N.W.

At last Monday's meeting of the members of the Royal Institution, a letter was read from the Hon. Sir C. A. Parsons, K.C.B., F.R.S., enclosing a cheque for £5,000, which he said "might be of some help at the present time." The managers passed a resolution expressing their most grateful appreciation of Sir Charles's munificence and discernment in unconditionally placing the sum at their disposal for the purposes of the Institution. The resolution read:—"They accept the gift as a timely and noble recognition of the good public work the Institution has done in the past, and is still doing, in the acquisition and diffusion of scientific knowledge, and as an incitement to maintain and extend its usefulness in the unique position which it has for more than a century occupied."

Mr. Wm. E. Hemingway has been appointed by the Dewsbury B. of G. as electrician to the workhouse.

The Erie Pump and Equipment Co., Erie, Pa., have appointed as sales engineer Mr. N. H. Brown, who was until recently Chicago representative of the Bury Compressor Co.

We congratulate Mr. Alan A. Campbell Swinton on being selected by the Council of the Royal Society for recommendation for election.

Obituary.—The official announcement of the Singapore riot of February 15th stated that Mr. Belfield North Woollcombe, who, with his wife, was killed, was an official of the Eastern Extension Telegraph Co. It is stated that Mr. G. O. Lawson, of the Singapore Volunteer Rifles, who was also killed, went out to Singapore as an electrical engineer about three years ago.

It is reported in a financial daily that Mr. Fred W. Lawson, of Leeds, a director of Fairbairn, Lawson, Coombe, Barbour & Co., died at Bath on February 24th.

The funeral took place at Blackamoor Church, Blackburn, on February 25th, of Mr. Robert Dugdale, of 431, Bolton Road, Ewood, an electrical installation contractor of Preston New Road. Death was due to pneumonia.

Mr. Charles Holliday, who has died at Crossgates, at the age of 69 years, was a former chief superintendent of telegraphs at Leeds Post Office, retiring in 1906, on reaching the age limit. He joined the Electric Telegraph Co, in 1860, and shortly afterwards became an operator with the United Kingdom Telegraph Co. In 1901 he was made superintendent in succession to the late Mr. E. Trenam.

NEW COMPANIES REGISTERED.

Smith & Mortimer, Ltd. (139,485).—This company was registered on February 26th, with a capital of £1,000 in £1 shares (210 preferred "A," 30 preferred "B," and 760 ordinary), to carry on the business of electrical engineers, automobile and accessory manufacturers, engineers, founders, smiths, contractors and manufacturers and sellers of an improved combined magneto lighting and charging set for the use of motor-propelled vehicles invented by C. H. M. Smith, and to adopt an agreement between H. Mortimer, C. H. M. Smith, H. W. Mortimer and S. J. Mortimer. The subscribers (with one share each) are:—H. Mortimer, Shanklin House, 41, Crescent Gardens, Bath, auctioneer; C. H. M. Smith, "South Brook," London Road, Bath, electrical engineer; H. W. Mortimer, 15, Crescent Gardens, Bath, accountant; S. J. Mortimer, Shanklin House, 41, Crescent Gardens, Bath, automobile engineer. Private company. The number of directors is not to be less than two or more than four; the first are H. Mortimer, C. H. M. Smith, H. W. Mortimer and S. J. Mortimer (all permanent); qualification, £50; remuneration as fixed by the company. Solicitor, J. S. Carpenter, 2, Pierrepont Street, Bath.

Surrey Electrical Co., Ltd. (139 460).—This company was registered on February 24th, with a capital of £2,000 in 1,750 6 per cent. preference shares of £1 each, and 5,000 ordinary shares of 1s. each, to carry on the business of manufacturers and sellers of electrical appliances, lamps and electrical novelties, motor appliances, &c., and to adopt an agreement with F. R. Marks, E. Dance, A. T. Redgwell, F. Tammage and F. Coates. The subscribers (with one share each) are:—F. R. Marks, Sussex Lodge, Wimbledon Park Road, Wandsworth, S.W., merchant; J. D. Cassels, Spring Lodge, Southfields, S.W., barrister; E. Dance, 57, Geraldine Road, Wandsworth Common, S.W., traveller. Private company. The number of directors is not to be less than three or more than five; the first are F. R. Marks, J. D. Cassels, E. Dance and A. T. Redgwell; qualification, 250 ordinary shares. Registered office, 77, East Hill, Wandsworth, S.W.

East London Electric Co., Ltd. (139,431).—This company was registered on February 23rd, with a capital of £1,000 in £1 shares (500 6 per cent. cumulative preference), to carry on the business of electrical engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic and galvanic apparatus, &c. The subscribers are:—W. B. Allcock, March Green House, Dagenham, electrical engineer, one ordinary share; P. H. Dipple, 186, Barking Road, Canning Town, E., licensed victualler, one preference share. Private company. W. B. Allcock is permanent governing director, with 20 per cent. of the net profits as remuneration. Solicitor: J. Hands, 97, Gresham Street, E.C.

Electrodes, Ltd. (139,422).—This company was registered on February 22nd, with a capital of £10,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, apparatus and appliances for the production of light in reflectors and projectors, electricians, engineers, makers and suppliers of electricity, &c. The subscribers (with one share each) are:—A. M. Billington, Suffolk House, Laurence Pountney Hill, E.C., civil and electrical engineer; A. M. Hay, jun., Suffolk House, Laurence Pountney Hill, E.C., insurance broker. Private company. The number of directors is not to be less than three or more than five; the first are A. M. Billington (permanent) and others to be appointed by the subscribers: qualification, £100. Registered office, Suffolk House, Laurence Pountney Hill, E.C.

David Wilson's Patent Noiseless Winch Co., Ltd. (139,421).—This company was registered on February 22nd, with a capital of £25,000 in £1 shares, to carry on the business indicated by the title, and that of electrical and mechanical engineers, manufacturers and sellers of machinery, and to adopt an agreement with D. Wilson. The subscribers (with one share each) are:—D. Wilson, 18, Greenkeys Road, Liscard, engineer; W. H. Pealing, 604, Tower Buildings, Liverpool, secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration as fixed by the company. Secretary, J. S. Haynes. Registered office, 38, Drury Buildings, Water Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Suppliers' Construction Co., Ltd. (66,081).—Capital, £350,000 in £5 shares. Return dated December 31st, 1914. All shares taken up. £350,000 paid. Mortgages and charges: Nil.

Sun Electrical Co., Ltd. (63 261).—Capital, £45,400 in £1 shares (20,000 preference). Return dated December 29th, 1914. 17,141 preference and 5,400 ordinary shares taken up. £12,541 paid. Mortgages and charges at date of return: £3 325, since registered; satisfaction to the extent of £275 on February 9th, 1915, of debenture stock dated March 31st, 1911, originally securing £7,000.

Electro-Mechanical Brake Co., Ltd.—A mortgage on land in Moor Street, West Bromwich, with the Eagle Foundry thereon, dated February 1st, 1915, to secure all moneys due or to become due from the company to the London City and Midland Bank, Ltd., 5, Threadneedle Street, E.C., not exceeding £7,500, has been registered.

Bishopscastle Electric Light and Power Co., Ltd.—Particulars of £500 debs., created February 8th, 1915, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £180. Property charged: The company's undertaking and property, present and future. No trustees.

Spensers, Ltd.—Issue on February 17th, 1915, of £850 second debs., part of a series of which particulars have already been filed.

Shipston Electrical Co., Ltd.—Particulars of £200 third debs., created February 20th, 1915, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

CITY NOTES.

Lancashire United Tramways, Ltd.

The directors report that the result of the working of this and the operating companies comprised in this company's system, worked out as though they were one combined undertaking, is as follows for 1914:—Traffic receipts £85,144, miscellaneous receipts and electrical energy sold £5,889, = £91,033; less working expenses £52,786, cost of generating electrical energy sold £2,718, general charges (including direction, management, interest, etc.) £5,401, rent of leased lines £5,188, = £66,093, leaving £24,940, plus dividend on holding in the New St. Helens and District Tramways Co., Ltd. £1,534, making the profit of combined undertaking £26,474. The receipts, compared with those of the previous year, show an increase of £3,472, notwithstanding a decrease in traffic receipts of £1,889 since the outbreak of war. The receipts amounted to 8.91d. per car mile.

The increase in expenditure amounted to £4,651. This was due principally to the additional expenses occasioned by the working of the Little Hulton and Farnworth extensions and motor coaches, and to heavy cost of maintenance of permanent way, owing to the increased wear and tear of the track by heavy motor goods traffic. During the year the rates of pay to employés have been increased.

The company is making allowances to the dependents of men who have joined the colours. Down to December last £230 had been granted.

Three motor coaches were purchased at the end of May, but the chassis were impressed by the military authorities early in September. They proved successful during the short period they were running. The profit amounted to £241, after writing off the loss on the sale of the vehicles. Orders have been placed for new chassis to enable this traffic to be resumed at the termination of the war.

The interest and dividends received by this company from the operating companies, together with sundry receipts, amounted to £14,438. After deducting interest on the prior lien debenture stock and expenses, there remains £158, which has been carried to depreciation account. There is also an undivided surplus on the year's working of the operating companies, after payment of the interest and dividends before mentioned, of £13,816. The depreciation and renewals accounts and amounts carried forward in the combined companies now amount to £38,744.

During the year 17 cars have been fitted with top covers, and the directors propose to cover a further number of cars this year.

Owing to the increased demand for power, a new agreement has been entered into with the Atherton Urban District Council for the supply of electrical energy for 20 years from January 1st, 1915.

The Hon. Arthur Stanley, M.P., presided over the annual meeting, held at Winchester House, E.C., on Friday last. He said that the profit of the combined undertaking for the year amounted to £26,474, as against £27,653 in 1913. The profit in 1913 was over £8,000 in advance of any previous year, and considering the abnormal conditions obtaining in the last few months the profit of the past year was a fairly satisfactory one. The increase in receipts was £3,472. Up to the end of July the traffic receipts showed steady weekly increases aggregating £5,000 for the seven months, but from the date of the outbreak of war there had been a considerable decrease in traffic. The running of the three motor coaches for three months resulted in a profit of £241. Those coaches had been commandeered by the Government, but their experience during the short time they were working confirmed their action in entering on this branch of passenger traffic, and they had therefore made arrangements to resume same as soon as possible after the war. The expenditure had increased by £4,651. The working of the Little Hulton and Farnworth extensions for a full year as against four months in 1913 accounted for £1,500 of this; higher rates of pay to workmen £800; and the maintenance of permanent way had gone up by £2,300. This was due to the great increase in wear and tear of track by motor goods lorries. The number of these vehicles now on the roads, and the certainty of further expansions in this traffic, had created a serious problem for those responsible for road maintenance. Tramway authorities had discussed the matter at length, and in the near future it was hoped that some concerted action would be taken to relieve those undertakings of the very onerous conditions which now obtained in connection with the maintenance of the highways. They had adhered to their practice of transferring from the operating companies just sufficient revenue to meet the interest on the prior lien debenture stock, consequently £13,816, representing the balance of profit of the combined undertaking for the year, had been retained by the operating companies, the greater portion having been placed to renewals account, and the remainder carried forward. The depreciation and renewals accounts and amounts carried forward in the combined companies now amounted to £38,743. Owing to the increased demand by the Atherton Urban District Council for the supply of electrical energy, it had become necessary to make further additions to the generating plant, which they proposed to do this year. In consequence of this they had thought it advisable to enter into a new agreement with the Council, who had agreed to extend the period during which they would take a supply from them from ten to twenty years. Up to date 129 employés of the associated companies had joined the colours. In the cases of married men and single men with dependents they were supplementing the Government allowances, so that each family received not less than the average wages earned before enlistment.

Mr. J. S. Austen seconded the motion.

The report was adopted.

(*Continued on page* 329).

THE ELECTRIC VEHICLE.

The advantages of using the electric vehicle for municipal services in the initial stages of the electric vehicle movement in this country, have been pointed out on more than one occasion by ourselves and others. But municipal bodies are proverbially slow to move, and the difficulties of penetrating the charmed circle of municipal thought with a new idea have perhaps been under-estimated, certainly so in those only too numerous cases where an apathetic chief engineer has not taken the trouble to investigate the claims of the "electric" and to enlighten the Council as to its possibilities.

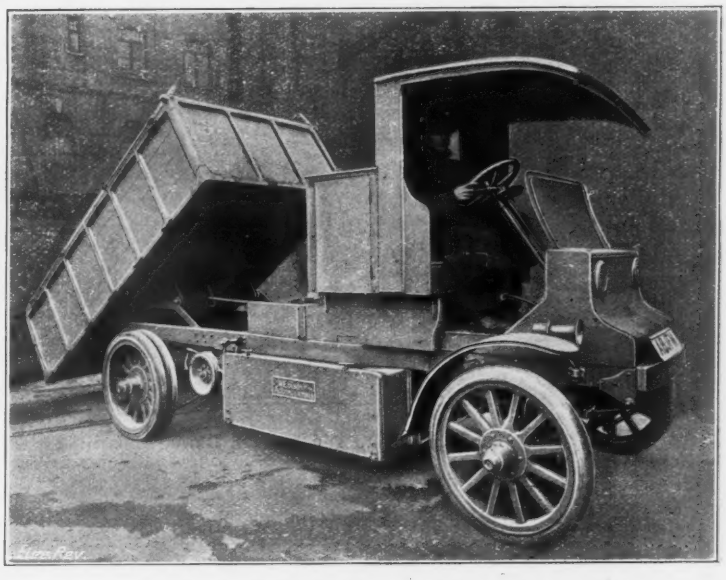
A Corporation which owns both electric lighting and tramway undertakings, and yet cannot find a place for the electric battery vehicle amongst the road equipment of its various departments, cannot expect the inhabitants of the town to attach much weight to any arguments in its favour. An ounce of practice in a case of this sort is worth a ton of theory, and it is up to our municipal authorities to lead the way—as in fact they did when the more expensive but more efficient electric tramway superseded horse traction.

A few municipal authorities are now taking a really active interest in the electric vehicle; a number can also lay claim to be supporters of the Electric Vehicle Committee, which is a very different thing; while of the remainder we should not be surprised to hear that a considerable proportion had not perceived, even if they have heard of, the existence of the electric vehicle.

In justice to the Electric Vehicle Committee, we may add that it has always appealed to us as a shining example of unity of purpose, and we do not doubt that it has done yeoman service in bringing together the various interests involved, and in ensuring some semblance of method in the initial stages of the movement.

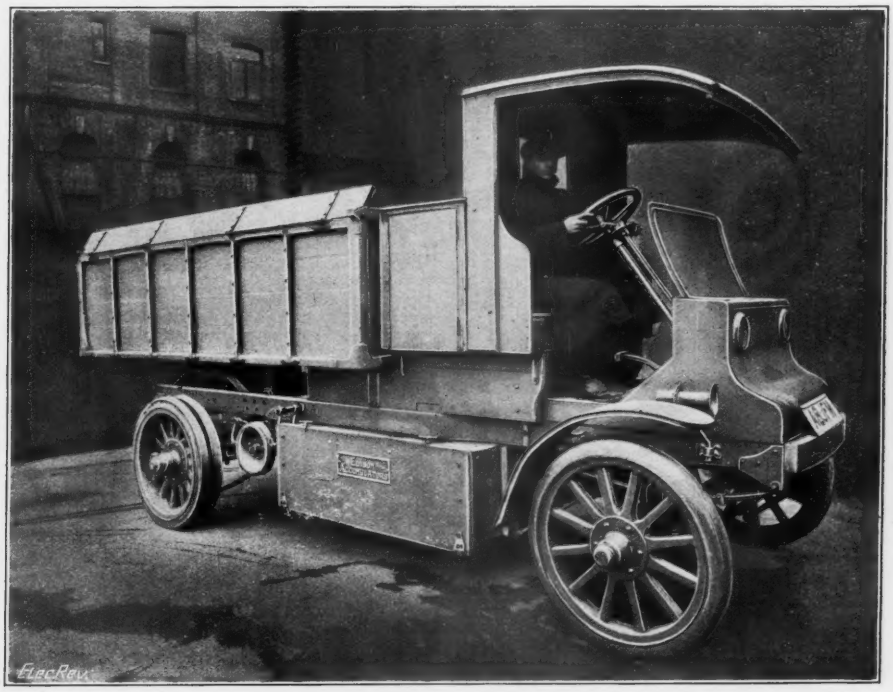
The power of the Committee for good, however, is dependent on the support accorded to it, and it seems pertinent at the moment to inquire just how far this is being given by our station engineers.

It would be a thousand pities were the introduction of the electric vehicle to be hindered at the present time, when events—ill in other respects—have conspired to give it an advantage over the too easily requisitioned horse or petrol vehicle.



Edison Dust-van, showing Body Tipped.

At the moment a good deal of interest is being taken in the electrically-propelled dust van, and trials of such a vehicle have been carried out at Hounslow, Barnes, Wolverhampton, Birmingham, West Bromwich, Sheffield and Croydon, resulting in certain definite recommendations. For instance, Mr. G. Bruce Tomes, surveyor to the Barnes Urban District Council, has reported to his Council on the experimental use of two electrically-propelled dust vans, which have proved very satisfactory and resulted in a recommendation for the purchase of four such vans.

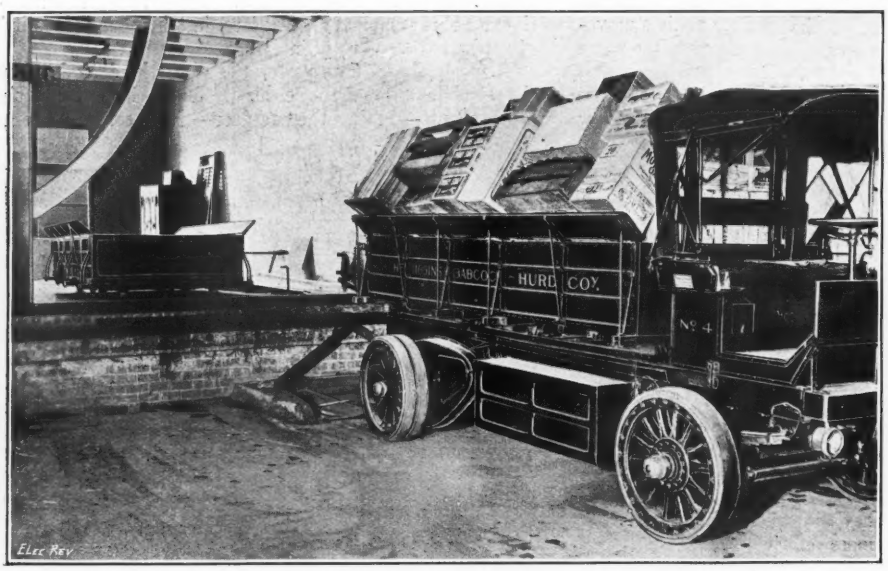


2-ton Edison Battery-driven Dust-Van.

We gather that the first van tried was supplied by Edison Accumulators, Ltd. The cost is stated to be £945 complete with chassis, battery and tipping body; the body is tipped by a small motor driven from the main battery, and only takes from 10 to 15 seconds to tip. The speed of the van is about 10 miles an hour, and it has a radius from 40 to 45 miles.

During the time it was at work, careful tests were made

of the mileage, current consumed, &c., and the running cost per day, including interest and repayment on the loan, wages, current, tires, maintenance of battery and chassis, insurance,



Baker Electric Truck, with Detachable Body.

and oil waste and sundries, &c., worked out at 19s. 4d. per day. This includes an allowance for charging apparatus.

The second van was a Baker electric chassis supplied by the Wolseley Motor Co. The price of the chassis with battery is given as £660, and a body with hand-tipping gear would bring the cost up to £750. The speed is somewhat less, but the radius and running cost works out the same as in the former case.

With regard to the work done, it was found that one van will take the place of 16 horses per week, and as the number of horses and carts required for dust removal averages 62 per week, four vans will do the work with a small margin to spare. On these lines the comparative cost would be as follows: —

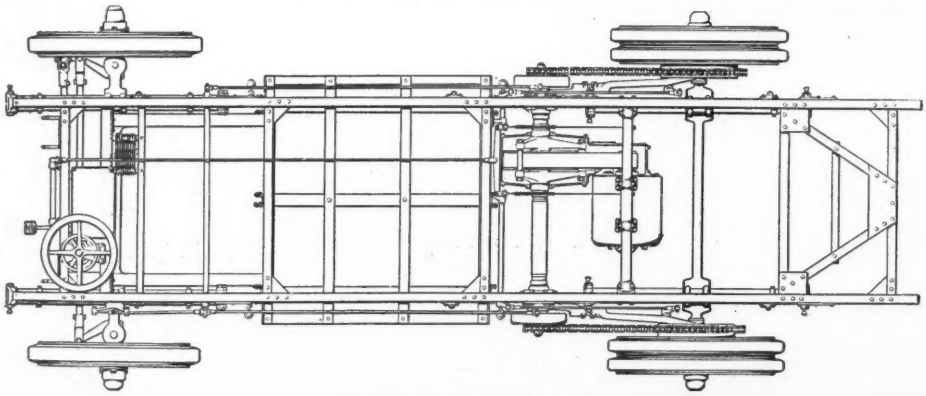
62 horse-cart days, at 11s. = £34 2s.

24 dust-van days, at 19s. 4d. = £23 4s.; two extra fillers to replace one-fifth of time of 10 carmen employed in filling, each at 30s. = £3, making a total of £26 4s., which represents a saving per week of £7 18s., and a saving per year of £410 16s.

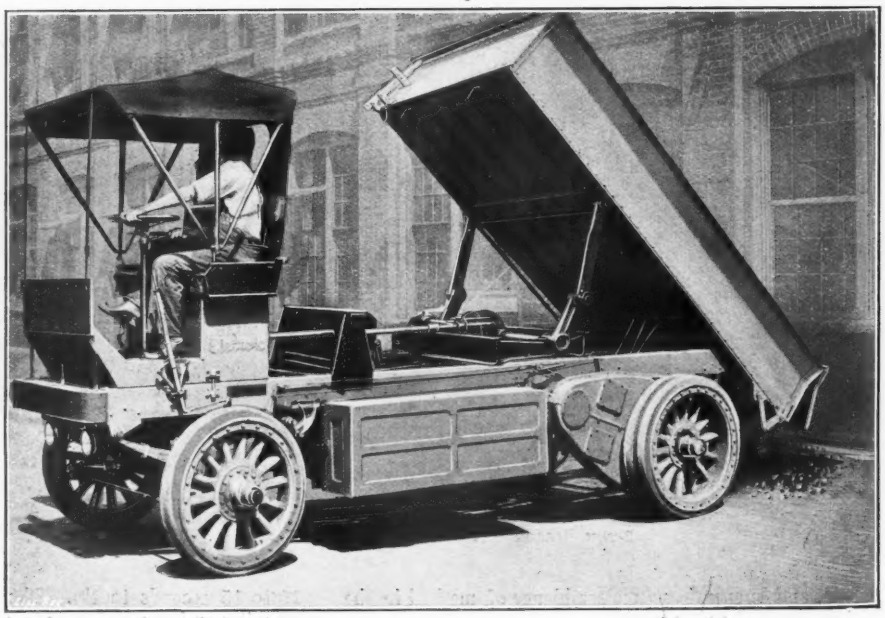
Notwithstanding a capital expenditure of £4,000, a saving of at least £400 per annum can be effected by the change of system.

The comparison can also be made in a somewhat different way by the number of cubic yards collected. A motor-van collects 28 loads per week, and four vans would collect 112 loads per week, which, at 4½ cb. yd. per load, would make 504 cb. yd. A horse and cart collects 21 loads per week, and at 10⅓ carts per day (the number now in use) would collect 217 cart-loads, which at 2¼ cb. yd. each would make 488 cb. yd. Four motor-vans would therefore do the work with 16 cb. yd. to spare.

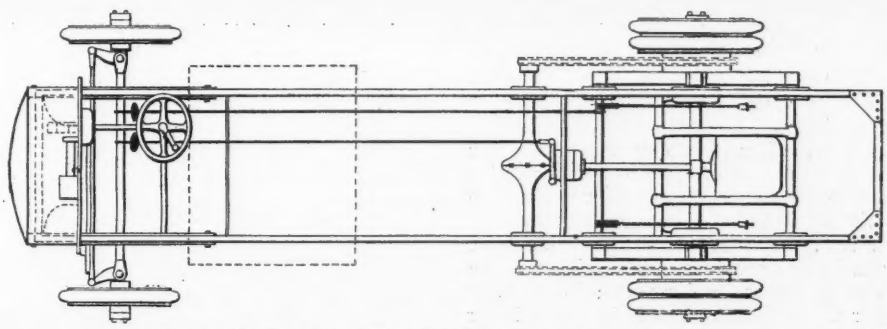
The most striking point in the statistics is the great difference in the times occupied by the two classes of vehicles in "collecting" and "travelling."



Plan of 2-ton Baker Chassis.



Baker Electric Dust-van, showing Body Tipped.



Plan of Edison 2-ton Electric Chassis, as used on Dust-van.

The horse and cart spends 2¼ hours per day collecting, and 6¼ hours per day in travelling to the destructor and back again. The motor-van spends an average of 5 hr. 56 min. per day in collecting, and 2 hr. 34 min. per day travelling to and from the destructor, thus reversing altogether the time in which the vehicle is effectively employed in the collection of refuse.

Mr. Tomes arrives at the obvious conclusion that a change of system should be adopted, and motor-vehicles substituted for horse-drawn vehicles for the purpose of house-refuse removal.

The following tabulated data regarding the performance of the Edison van during the week's test may also be of interest :—

Average number of loads per day	5
Total number of loads per week...	30
Average number of miles per day	22·65
Total number of miles per week...	113·5
Average energy per day	22·15 units.
Total energy per week	126·9 ,,
Number of fillers (two days only, 2)	3
Total time collecting	35 hr. 40 min.
Total time journeys to and from destructor and tipping...	14 hr. 30 min.
Average time collecting per day (less Saturday)	6 hr. 16 min.
Average time on journeys per day (less Saturday)	2 hr. 38 min.
Average number of loaders	7·3
,, time of loading	49½ min.
,, ,, unloading	10 min.
,, ,, working day	10 hr.
,, mileage from destructor	4·2
,, stops per journey	37
,, time of boost of current per day (not imperative)	50 min.
Total weight carried	70 tons 13 cwt.
Average weight per day	11 tons 15 cwt.
Total current used	159 units.
Cost per mile	1d.
Weather conditions	Very wet.
Road conditions...	Muddy and soft.
Number of horses replaced	Nearly 3 per day.
Loaders' time averaged	40 hr. per week.
Loaders employed on road-sweeping, balance of time.	

We understand that the Croydon Municipal Authorities are giving careful consideration to these results with a view to employing several 3-ton vehicles.

In the case of Sheffield, unofficial figures for a trial extending over a day and night show that during the day three experimental trips were made, 6 ton 3 cwt. being carried a distance of 19½ miles, on 22 units, while at night five similar trips were made between 11.30 p.m. and 6.20 a.m., the time occupied on each journey (out and home) being roughly one hour. Some 10 ton 14 cwt. was carried a distance of 10½ miles on 12 units. The standard 2-ton Edison tipping van, to which reference has been made, is equipped with 60 A-8 type Edison cells, for operating a single enclosed type motor (72 volts, 40 amp., 900 R.P.M.), which has a flexible shaft drive on to a differential counter shaft, and roller chain drives connecting each end of the latter to sprockets on the rear wheels.

Electric Horse Ambulance by the Commercial Truck Co., New York (see page 328).

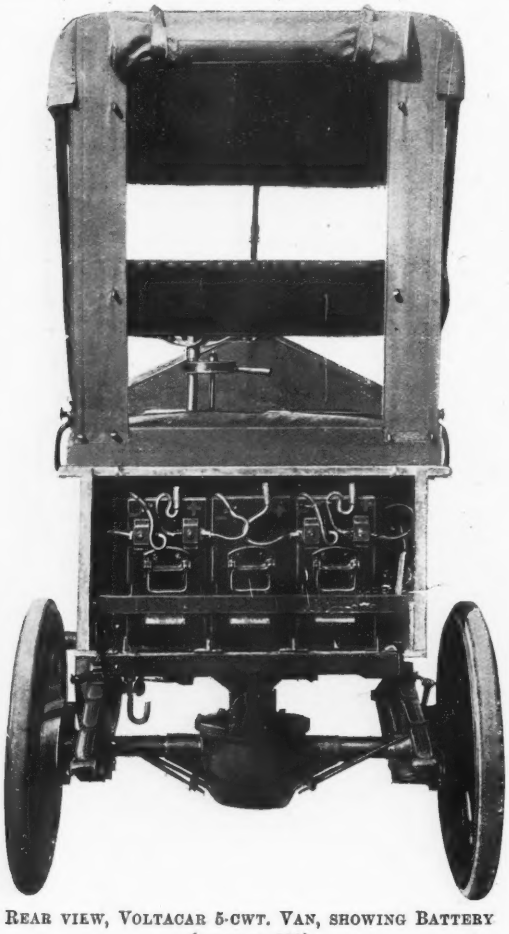
Rather more detailed but unofficial figures regarding another week's test of the same Edison van at Croydon are as follows : —

Total mileage	163
Average mileage per day	27
Total loads collected	32
Average loads collected per day	5·3

The flexible shaft drive is a feature of the vehicle, the shaft consisting of a flat spring tempered-steel blade, which is self-aligning and exercises a cushioning action which tends to save the vehicle from undue stress while at work and increases its efficiency.

The accumulator can be housed in a compartment below the driver's seat and on the top of the chassis, this position having advantages in the matter of accessibility under some conditions and offering good protection to the battery.

The controller is of the continuous-torque drum type, giving five forward and two reverse speed positions with a positive stop between forward and reverse; it is placed under a hood in front of the dash where it is accessible for inspection. Ball and roller bearings are fitted to the wheels, motor, differential, &c. The vehicle is provided with a safety switch operated by a driver's key, also with a



Rear view, Voltacar 5-cwt. Van, showing Battery (see page 329).

Sangamo ampere-hour meter, reading the input to the battery when charging, thus giving a ready check on bills for power.

The rated travel of the vehicle on one charge is 40 miles fully loaded and the speed under good conditions, 11 to 12 miles an hour. The dust-van is fitted with a sheet-steel body provided with automatic tipping gear. This is an electrically operated device put into action by a simple reversing switch. A small electric motor gives the body a direct thrust backwards through the medium of a reduction gear and square threaded screw of ample proportion.

The body is provided with rollers, which run on a steel runner path of special profile, such that when the body is pushed backwards, a tilting motion is also given to it. This arrangement possesses the advantage that the bodywork is stable in all positions, whilst the centre of gravity travels almost horizontally; thus the amount of energy used for tipping, and the time taken for the process, are greatly reduced as compared with other mechanical methods in use for effecting this action.

We are able to illustrate, on page 326, a Baker electrical tipping van of the type tried at Barnes. This vehicle is equipped with 42 Exide ironclad cells carried in a cradle slung under the chassis frame. A single series-wound motor is fitted and drives through a Renold silent chain to the counter shaft, while two roller chains couple the latter to the rear

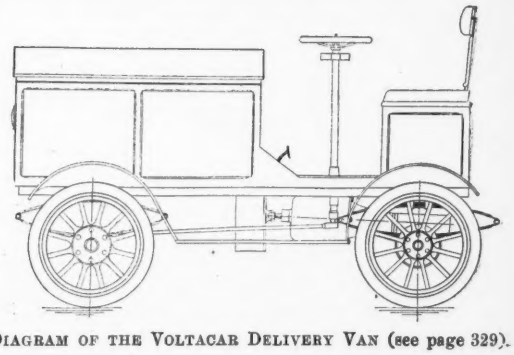


Diagram of the Voltacar Delivery Van (see page 329).

wheels. Timken roller bearings are fitted in the front and rear wheels, and roller bearings on the motor and counter shaft. The working mileage per charge is about 40.

An Electric Motor Ambulance for Horses.

Notwithstanding the great increase in the use of automobiles, it is estimated that no less than 15,000 horses died in New York last year, of which over 1,000 were taken from the streets for treatment in veterinary establishments. The removal of dead horses from the streets is attended to by the New York Department of Health; the care of sick horses devolves upon the veterinarians of the city, while emergency relief is undertaken by the American Society for the Prevention of Cruelty to Animals, which was started about 40 years ago, and which maintains horse hospitals in Manhattan and Brooklyn. The present ambulance equipment consists of seven vehicles, five of which are horse-drawn, one is of the petrol-electric type—but is to be converted to an electric vehicle—while the latest, which was put into service last spring, is an electric vehicle built on a two-ton chassis by the Commercial Truck Co., of New York. As will be seen from the illustration (page 327) of the ambulance, for which we are indebted to the *Edison Monthly*, the rear axle is dropped in order to enable the floor of the vehicle to be brought close to the ground. For convenience in handling sick horses, the vehicle is provided with an additional bottom board or stretcher which can be rolled down the inclined tailboard to the street. The horse is strapped to this, and then, by means of an electrically-operated winch and cable, is hauled into the vehicle. The battery of accumulators is carried in a compartment below and behind the driver's seat, and the vehicle is driven by motors mounted on the front axle. The vehicle has a maximum speed of 14 miles per hour, and has covered a

The Voltacar Electric Tradesman's Van (see page 329).

distance of 40 miles on a single charge. So far its longest emergency call required a round trip of 32 miles. It is during the hot summer months and in the winter when the streets are covered with ice, that the ambulances of the Society

are busiest. As many as 55 calls have been answered in a single day, while frequently there are 30 or more.

Edison Vehicle Progress.

It may be of some interest to our readers to know that Messrs. Edison Accumulators, Ltd., have had orders placed for 36 vehicles during the present year. These include 18 half-ton delivery vans for Messrs. Harrods; also vans for the Wilts United Dairies and Hovis, Ltd., and a truck for Messrs. Hadfields.

For municipal service the Liverpool Corporation has ordered a 2-ton van, and the Glasgow Corporation ½-ton, 1½-ton, and 3-ton vehicles; while, we understand, that the Edinburgh Corporation is also obtaining a 30-cwt. van.

Following the lead of South Shields in regard to Edison battery 'buses, four similar vehicles have been ordered by the West Bromwich Council, and an equal number by the York Corporation; the Loughborough Motor Omnibus Co. has ordered one 'bus with the option of taking three more this year.

As previously mentioned, the Barnes Council has also decided to purchase four Edison electric dust-vans with automatic tipping bodies.

Light Electric Delivery Van.

A vehicle, which has been named the "Voltacar," has lately been introduced by the Cyco-Lectric Co., of 1,790 Broadway, New York. It carries 5 cwt., and is intended to meet the requirements of small tradesmen and others having need for some means of making frequent and rapid deliveries within a restricted area.

The mechanical portion of the chassis is of simple design. The electric motor, taking 40 amperes at 28 volts, is mounted centrally in the pressed steel frame, and drives the back axle through a longitudinal propeller shaft and overhead worm gear. A universal joint is introduced between the shaft of the motor and the propeller shaft, the latter being also provided with a sliding joint at its rear end.

The necessary current is supplied by a battery of 12 lead or 24 Edison cells, the capacity being stated to be sufficient for a run of from 35 to 50 miles on one charge at a speed of 15 miles per hour. In order to provide sufficient traction whether the vehicle be empty or loaded, the accumulators are carried in a receptacle above the back axle, this receptacle also forming the driver's seat.

Owing to the employment of a low-voltage battery, the individual machine with single battery would be unduly expensive; for this reason purchasers are being given an opportunity of purchasing two extra batteries with the machine, so that all three can be charged at the same time with maximum economy; furthermore, the user will always have a battery in reserve ready for emergency service needs.

The controller, the lever of which is mounted below the horizontal steering wheel, works in a notched quadrant plate, so that there is no danger of accidental reversal of the machine. The mechanical details have been worked out with great care, one example of the up-to-date design being seen in the front steering road wheels, the hubs being made concave so that the steering pivots fall in the vertical plane of the wheel centres, so greatly reducing the wear on the tires. The usual brakes, operated by a pedal, are fitted to drums connected with the hubs of the rear wheels.

The vehicle has a wheel base of 5 ft. 8 in., and a track of only 3 ft. 4 in., so that it can be stored in a relatively small shed. The body, which has a volume capacity of about 24 cb. ft., is provided with lift-up doors at either side.

A feature of the vehicle which will appeal to the tradesmen for whom it is intended is its relatively low price, £117, complete with battery. As a means of popularising the new vehicle, an original scheme of contract service has also been devised, by which a tradesman can buy a vehicle without the battery at a proportionately reduced cost, while the battery and all service will be supplied by the company. This work will include the exchange of the discharged battery for a fresh one once a day, or oftener if required, maintenance of the car in first class condition, including the replacement of all parts from whatever cause, and also the the tires and repainting of the vehicle once a year. For this service a flat rate of 9s. 4d. per day will be charged.

A further project of hiring out the vans with uniformed drivers at a flat rate of 16s. 8d. per day is also in contemplation.

A second type of van has been developed by the Cyco-Lectric Co., with the driver's seat at the front—the battery being below it—and a van body behind, with a capacity of about 50 cb. ft.

CITY NOTES.

(*Continued from page* 324.)

South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. John Winkworth presided on Monday, at Winchester House, E.C., over the annual meeting. He first referred to the war, and stated that 24 per cent. of the staff had joined the forces of the Crown, which was the limit the company could spare, bearing in mind its serious responsibilities. The company had agreed to reinstate the men at the end of the war, and in the meantime to make up the difference between the Army and Navy pay and the full salary or wages each man was receiving. Notwithstanding the war, the progress of new business had been fully maintained. Five hundred and eighty new consumers and 41,277 lamps (equal to 1,179 kw.) were connected during the year. The latter figure, however, included an addition of about 9,000 lamps (35-watt) made as the result of an inspection during the year of the large power installations, which revealed the fact that additional motors had been connected without notice to the company, the whole of which might not have been added during the year. Indeed, some might have been added during the previous year, and some even before that. The recount brought their installation particulars up to date. Apart from this, the growth of new connections within the year had created a new record, and was well above the average of the last three years. Turning to the revenue account, however, as might be expected in the abnormal conditions of the last five months of the year, the increase in the revenue had not kept pace with the increased business obtained, due to restricted lighting, a general desire to economise, and reduced demands for certain classes of power. The factory load was also affected in the earlier part of the year by a dispute in the building trade. The total units sold amounted to 6,695,481, as compared with 6,662,842 last year, an increase of .5 per cent. Although considerable additions were made to the connections for power, the factory load fell off by about 165,000 units, which was a little more than made good by increased sales for lighting, heating and cooking, and the average price realised was a trifle higher in consequence. The receipts at £62,068 showed an increase of £970; rental of meters and apparatus on hire was about £200 more, and the total receipts amounted to £66,791, an increase of £1,157. On the other side, there was a saving in the cost of coal of £890, which was very gratifying, especially in view of the adverse conditions of the last few months; wages were about £322 up, and there was also an increase of £246 in the management salaries, part of which was due to the special payments which they were making to those who had joined the colours. Insurances were a little more, due to the cost of insurance against damage to the works and revenue through aerial craft, and development expenses were about £200 more, as after the commencement of the war the transactions in the sales of fittings, etc., which up to that time had again shown an improvement over the previous year, began to fall off. During the months of August, September, and October new business was very difficult to obtain. The total sales in the show-rooms for the year amounted to £8,150, as compared with £10,050, and the number of transactions was therefore reduced to about 3,750, as compared with 4,480 in the previous year. There had been an improvement of late, and the returns for the last two months had been about the same as for the corresponding period of last year. The total expenditure amounted to £23,737, and showed a decrease of £327, as compared with the previous year, and the net revenue amounted to £43,054, an increase of about £1,500 for the year, which was very satisfactory in the circumstances. The general manager estimated that the loss of net revenue through the war amounted to about £4,000, which meant that they should have had an increase of at least £5,000 in the net profits for the year in normal conditions. The earnings of the company for the past year, after providing for debenture interest and dividend on the preference shares, amounted to a little over £16,000. As the provisions of the debenture trust deed would require the company to set aside to a special reserve fund for depreciation, etc., about £15,374 for the past year, if any dividend were paid on the ordinary shares there would not remain out of the profits of the year a sufficient sum available for such dividend. In these circumstances, and in view of the uncertainty of affairs owing to the war, the directors considered, and he was sure the shareholders would agree, that the best interests of the company would be served by strengthening the financial position at

the present time. The business of the West Kent Co. was being actively developed, and the net revenue for the past year showed a satisfactory profit upon the capital employed. Further important orders for power and light had been secured, which guaranteed a gross revenue of nearly £10,000 for the present year, and a minimum of over £20,000 a year from January 1st, 1916. The greater part of these demands would be supplied from the South Metropolitan Co.'s power house. E.H.T. mains were now being laid to afford the supply, which were expected to be completed about the middle of this month. He was pleased to say the West Kent undertaking was becoming an important and valuable property, and as the South Metropolitan Co. held practically all the shares of the West Kent Co., whose powers were held in perpetuity, it would benefit materially by its profitable development. It was very difficult to give any forecast of the future in the present disturbed state of affairs, but the progress of new business continued, the number of orders obtained up to date being about the same as for the corresponding period of last year, while the factory load for the month of January of this year was practically the same as for January of last year, and the meters at the works recorded an increased output. On the other hand, they were having some difficulty in connection with the delivery of coal. The contracts were made at reasonable prices to satisfy their requirements until the middle of next year, but it was difficult to obtain proper deliveries. Moreover, the quality of the coal, as frequently happened in times of shortage, was not up to the proper standard. They were providing for part of their requirements by the use of coke breeze, and every effort was being made to keep the generating costs at as low a figure as possible. In conclusion, the Chairman referred to the loyal services of the staff, to whom he considered the thanks of the company were greatly due.

Mr. H. W. Bowden (engineer-in-chief), in seconding the motion, said that notwithstanding the year under review being an abnormal one, their costs of generation were again the lowest on record for the company. The last new turbine plant had been largely responsible for the improved results in the generation of energy. The machine was put into commission in May, 1913, and had proved highly satisfactory. The work done during the year by this machine represented 8.37 million units out of a total 9.21 million units generated at the power house, equal to 91 per cent. of the total output. Important work had been carried out during the last few months in their efforts to burn inferior fuel, called "coke breeze." The fuel was of the lowest grade leaving the gas retorts, and could be obtained quite cheaply, owing to the power house adjoining the gas works. After inspecting several boilers on the Continent burning coke breeze successfully, a contract was entered into with the Gas Co. for the supply of breeze, and the apparatus placed on order to make a trial on one boiler. The results obtained (although by no means complete) had justified the trial and the arrangements then made. This was more marked if they had regard to the very high price of fuel at the present time. The boiler on test had been working almost continuously for the past few weeks on coke breeze unassisted by coal, producing practically the full output of the boiler. The saving in fuel was considerable, and if the results could be ensured without additional expense in repairs and attendance their costs of generation should in normal times show a marked improvement when further boilers had been equipped. So far as he was aware, it was the first power house installation in this country where mechanical stokers had been fitted and coke breeze burned successfully for several weeks together unassisted by coal without letting the fires down. He had on several occasions emphasised the importance of securing low generating costs, owing to the increasing demand made for power at very low rates. He ventured to think they had in a measure been successful in their recognition of this fact and thanks were due to the power house staff for the assiduous attention given in their endeavours to obtain this end, resulting in a reduced coal bill of approximately £900 for practically the same output as the preceding year. With regard to the distribution department, the usual extensions of mains had been made during the year. Considerable extensions were in progress for this year in order to meet the demands of the West Kent Co. Work had been started on the laying of cables for a distance of approximately nine miles, which should be completed by the end of next month. The efficiency of distribution had been slightly affected, partly on account of the power units being down and partly owing to these units being more widely distributed to additional power consumers, *i.e.*, the factories, within the immediate neighbourhood of the power house have not been so fully employed; and perhaps also owing to the restricted lighting.

Efficiency of distribution.—76.92, compared to 78.71 last year.
Output of feeders.—8.7 millions, compared to 8.46 millions.
Units sold.—6.69 millions, compared to 6.66 millions.
Maximum load.—4,200, compared to 4,700.
Coal cost.—0.30d., compared to 0.34d.
Works costs.—0.49d., compared to 0.51d.
Total costs.—0.85d., compared to 0.87d.

There was a reduction of 0.04d. in the coal costs, enabling the company to maintain second place for lowest generating costs of London supply companies so far as results were at present published.

Mr. Hughes asked if the amount which had to be paid under the debenture trust deed was cumulative. In other words, how much profit would the company require to make in a year before they could declare a dividend.

The Chairman said the amount to be set aside under the debenture trust deed varied according to the capital expenditure. Last year it was £14,700, and this year £15,374.

Mr. Joyce Thomas alluded to the fact that during the ten years he had held shares he had received but one dividend of 2½ per cent. He asked for some explanation regarding the issue expenses of capital.

Mr. Horace Boot asked if the company was to attain its silver or golden wedding before the shareholders received a dividend. Personally, he could see no dividend in sight until the debenture interest was out of the way. When the fresh capital was raised he strongly criticised the arrangement, and it really looked as if some of the shareholders were not fools, and foresaw what would happen. With regard to Mr. Bowden's statement, he would like to know the price at which he bought the coke breeze, because he himself went very fully into the question in regard to some big works. At that time the coke breeze was offered at 6s. a ton, and recently the price had gone up to 8s. 0½d. Mr. Bowden spoke of the same output with the coke breeze, but his experience of using it and trying to get the same output was that it meant reducing the life of the boiler by one half. They did not want that, for the future of the company rested on the capital expenditure being kept as low as possible.

The Chairman said the preference shares issued were issued to the shareholders, who were given a commission of 1s. for each share subscribed. But for the war there was no doubt but that year they would have had an improvement of £5,000 in net profits, which would have meant that they would have £20,000 available after providing for the debenture and preference share requirements, and would have enabled them to provide a reasonable dividend. The new business obtained last year had at any rate been fully equal to the average business obtained during the past three years, and they had large new business coming, as he had told them, and therefore in normal times they should be able to pay the ordinary shareholders quite a satisfactory dividend. Indeed, he believed they would be able to give the ordinary shareholder such a return as would repay him for the long years he had waited. He had every confidence in the inherent soundness of the undertaking, in the large undeveloped area, and also in the prospects of the West Kent Co., whose powers were held in perpetuity.

The report was then adopted.

Warrants for dividends, payable March 1st on the 7 per cent. cum. first preference shares and 6 per cent. cum. second preference shares, have been posted.

South Staffordshire Tramways Co., Ltd. — The accounts for 1914 show an available sum, including £603 brought forward, of £3,728. A dividend of 3½ per cent. on the preference shares is recommended, leaving £843 to carry forward.

City of Carlisle Electric Tramways Co., Ltd.— The gross revenue in 1914 was £10,311. After providing for repairs, maintenance, &c., debenture and loan interest, and appropriating £1,000 to reserve for redemption of second debentures, the credit balance of £33 brought forward was increased to £586.

Aberdeen Suburban Tramways Co. — The half-yearly meeting was held on Friday, when the directors' report and balance-sheet were adopted.

Manila Electric Railroad and Lighting Corporation.—The directors have declared a quarterly dividend of 1½ per cent. for the quarter ending March 31st.

Mansfield and District Tramways, Ltd.—The directors, after placing £1,400 to depreciation reserve and £1,000 to renewals fund, recommend a dividend of 6 per cent. on the ordinary shares for 1914, carrying forward £1,535.

John Spencer & Sons, Ltd.—An interim dividend at the rate of 5 per cent. for the half-year ended December last is recommended.

Brazilian Traction, Light and Power Co., Ltd.— The directors have declared a dividend of 1½ per cent., for the three months ending March 31st, on the 6 per cent. cumulative perference shares.

Metropolitan Electric Supply Co., Ltd.—Dividend on the ordinary shares for the last half of 1914, at the rate of 3 per cent. per annum, making 3½ per cent. for the year, compared with 4½ per cent. a year ago.

Mather & Platt, Ltd.

Sir William Mather presided at the annual meeting, held on February 26th, at the works at Manchester. Comparing the results of the business during 1914, he said that in his opinion they were very satisfactory. A dividend of 10 per cent. on the ordinary shares plus a bonus of 2½ per cent. free of income tax had been declared. In arriving at their statement of profit during the past year, the directors had thought it prudent to first secure the business against unforeseen contingencies that might arise in consequence of the unprecedented situation created by the sudden change from long years of peace to a state of war on a colossal scale. They, therefore, decided not to add to the already large reserve fund, but to carry forward a larger sum than ever before—£66,838. The directors did not anticipate a revival of active business with the countries engaged in war to any great extent during the war. The firm had contracts booked with such countries, but would be unable to execute them until after the war. Meantime, their works were fairly well employed and they had undertaken certain contracts which the Government placed with well-equipped firms. It was a popular delusion that Government contracts were exceedingly profitable. Such contracts had to be completed under tremendous pressure, and it was the duty of contractors on patriotic grounds to make every effort, regardless of cost, to supply the Government with what they needed; by strain and stress and all possible overtime the work had to be done to meet the demands. Another consideration which would affect the profits of most industrial concerns during the war was the indisputable fact that the cost of food had risen, and might still rise, to a price that would sensibly affect the workpeople of the country by seriously diminishing the purchasing value of wages. This was a grave question which employers and all concerned with industrial undertakings should meet sympathetically and patriotically with the desire to lighten the burdens of their workpeople. The working classes, being most numerous, furnished most of the fighting men. Their families would feel most acutely the pinch of excessively dear food. It was not right to ask sacrifices of them for the common weal greater than those which all other classes made according to their means. Charitable relief of the working classes was least effective and most demoralising. The greatest help that could be given to workpeople was to provide them with work at a living wage, adjusted to the cost of living frugally and carefully with self-denial and self-restraint on their part during the war. It seemed to him that company directors and shareholders should frankly face the facts affecting the people's food supply. Large dividends during war times should not be a primary consideration with them. They should first try to provide as much work as possible at wages that would enable workmen to reasonably nourish themselves and their families, having due regard to the avoidance of waste and self-indulgence. Business profits earned under those principles might be small, but shareholders ought to bear the sacrifice of part of their dividends as their contribution towards the relief of the universal suffering which the war had caused. Strenuous efforts should be made to keep the industries of the country alive during the war. Violent trade disputes on account of wages amounted to high treason at such a time. The war would pass all the sooner if those concerned in the industries of the country held well together, and after the war a long, lasting peace, with great prosperity, would repay them for the sacrifices they had now to make in order to secure the victory.

Northampton Electric Light and Power Co., Ltd.

The annual meeting was held at Northampton on the 25th ult. Mr. F. H. Thornton, J.P., presided, and said that the year had been one of continued success and progress. The company had sold nearly £2,000 worth more current than in the previous year, an increase of 8¼ per cent. In units the increase was 15 per cent. in power and 8 per cent. in current sold for lighting. They had done that with an increase of only £100 in the cost of coal. That was due to the fact that they had the advantage of the new turbine of 1,800 h.p., which was put in last year, and also to the fact that they bought their coal during the year at a decreased price of 6d. per ton. The company had experienced a great increase in the amount of current sold for cooking, which might be attributed to the fact that they were now letting out cooking stoves at 5s. per quarter, and people found that cooking by electricity was as cheap, if not cheaper, than any other form and much pleasanter. They had also had an increase in the current sold for heating, the new type bar radiator giving a very much better heat than the old type. On cold days there was a very appreciable increase in the quantity of current sold for heating. Those two things were most satisfactory, for they showed that people in the town were realising the possibilities of electricity for domestic purposes. They anticipated that they would go on in the future with as much success as in the past. The undertaking had developed in a way they never anticipated eight years ago. They did not anticipate that the cost of coal would increase very materially, and they had very favourable contracts for the ensuing year. Although they had had difficulty in getting coal along the railway, because of it being taken up for military purposes, they had been able to get an ample supply in consequence of the Government considering their undertaking to be a valuable concern in helping the boot industry, which was carrying out big Army contracts. The amount put to the reserve fund was £250 more than last year, but it was the right thing to be on the safe side in that respect. The year had been a strenuous one, but the staff had worked with as much keenness as if the undertaking had been their own. The great difficulty had been to obtain material to carry out orders, with which they were inundated owing to Admiralty contracts.

Mr. W. Tomes seconded. He said the great strides which had been made by the company could be seen by the way in which the mains had been extended throughout the town. They were already supplying one of the suburbs, and they might look for an increased custom in that direction.

Fife Tramway, Light and Power Co., Ltd.

Presiding at the annual meeting, held in Edinburgh, Mr. William Low said that the earnings from the Dunfermline and District Tramways Co. during the year, paid over to the company by way of dividends and management fees, amounted to £15,250, compared with £15,020 for the preceding year, and £12,200 for the year 1912. Keeping in view the abnormal conditions since the beginning of August last, shareholders were to be congratulated that this department had done so well. The growth of traffic continued steadily during the first seven months of the year, and at the end of July the earnings were over £1,000 in excess of the corresponding period for the previous year, due to some extent to the opening of an additional line. Notwithstanding the diminution in receipts during the latter part of the year, the tramways revenue was still slightly greater than for any previous year. The company had statutory powers for the construction of a tramway to Rosyth Naval Base and Inverkeithing. These powers expired in July next, and the directors had made application for an extension of time for construction, and for the laying of a connecting line along the North Queensferry Road. Turning to the power and lighting business, the Chairman said the revenue from the Fife Electric Power Co. and the electric light undertakings received by this company as dividends and management fees, amounted to £11,276, as compared with £8,561 for the preceding year—an increase of nearly £3,000. The increase in profits, although very satisfactory, would have been greater had normal conditions prevailed throughout the whole year. The additional generating plant at Townhill power station was installed during the year, and the capacity of the station was thereby nearly doubled. A coal conveyor gear was now being installed and would be complete in a week or two. The economy in coal-handling would largely compensate for any abnormal price of coal during the current year. The transmission lines and mains had also been extended during the year, increasing the number of prospective consumers brought within immediate reach of the company's supply. With reference to the current year, notwithstanding the disturbed condition of affairs the directors had every confidence that the earnings would be maintained, and even possibly increased. The earnings of the power company up to date this year were in excess of the corresponding period of last year, but it was somewhat difficult to forecast the earnings of the tramway company. The directors, however, felt confident that the combined properties would produce a result at least equal to that of last year. They had additional debenture powers of approximately £170,000. In the past their directors had taken care of extensions by the issue of ordinary and preference shares, without encroaching, except to a minor degree, on the borrowing powers of the company, which were in reserve for extensions in future.

Mr. George Balfour, in seconding the resolution, pointed out that the power company, without further expenditure, apart from expendture on incidental auxiliary plant and extensions to cables, was now in a position to sell an amount of electricity largely in excess of the present demand.

The report was adopted.

Rushden and District Electric Supply Co., Ltd.

The annual meeting was held at Northampton on February 25th. Mr. F. H. Thornton, J.P., presided, and in the absence of the Secretary (Mr. H. St. John Browne), who is away on active service, the duties of secretary were discharged by Mr. E. M. Browne. The Chairman said that for the first year's working the accounts were most satisfactory. There was a small net profit of £6 3s. 8d., and, considering they had nothing to start with, it was creditable to have a profit instead of a loss. The number of customers at the end of the year was 79, and since then it had gone up to 86. The quantity of current sold in the first quarter was £69, in the second £68, in the third £100, while for the Christmas quarter the receipts from the sale of current were £247. They might now look forward to going on upon a paying basis, as people were constantly being connected up. It was an extremely satisfactory thing that they sold so much current for motive power. At first people were a little shy of taking it, but one manufacturer who had just had his factory connected with the mains at once asked if he could buy some shares. That showed how satisfied he was. At the end of the year the number of lamps was 5,561, and they had since added about 1,000. The company was lucky in having oil as its chief fuel, as it was more easily obtainable along the railway at the present time than coal.

Mr. Clark seconded.

Liverpool Overhead Railway Co.

The annual meeting was held on February 23rd at Liverpool, Mr. H. C. Woodward presiding.

The Chairman said that the war had monopolised their thoughts and affected every industrial and trading enterprise, and especially the working of the great system of railways. Their system was placed under the care of the Railway Executive Committee, but that body did not interfere with the actual working and management in detail of the various railways beyond what military necessities might require. The plan involved the pooling of all net receipts, with the intention that those railways that showed an increased net revenue owing to the war, should contribute out of the excess to recoup, to a certain extent, those companies that suffered by diminished traffic. Consequently, as their revenue had increased, they had to pay over a certain amount, not yet exactly ascertained; but seeing that they already had an increase in the first half-year, they were practically guaranteed that they should be in no worse position than in the previous year; and on the whole he thought it was a fair arrangement, and was agreed to by all the great railway concerns. This plan, of course, affected the form of the accounts. They had carried during the past year, on railway and tramway, exclusive of season-ticket holders, a total of 13,361,944 passengers, being an increase of 178,623 over 1913, and nearly 1,200,000 over 1912, and it was the greatest number carried since the railway was opened for traffic. This represented an increase of 5 per cent. in their first-class and 1 per cent. in third-class, but a decrease in the "workmen" class of 3 per cent. The general increase was partly due to the presence in the spring of the new Cunard liner *Aquitania* in the Gladstone Dock, which proved a great attraction, while the encampment of troops at Seaforth, Waterloo, and Crosby materially helped their tramway traffic in the early autumn. After paying preference dividend they recommended a further dividend on the ordinary shares at the rate of 3½ per cent. per annum (making 3 per cent. for the year). The ordinary dividend was the same as for 1913. The total expenditure on railway and tramways amounted to £56,845, being an increase of £1,369. This was partly accounted for by an increase in wages and extra cost of coal. Out of their employés 42 had joined His Majesty's Forces, which was equivalent to about 12 per cent. of the whole of the staff, and this made them rather short-handed in some departments. It gave him great pleasure again to testify to the good conduct of the men and the ability and energy of the general manager (Mr. E. J. Neachell) and his principal assistants, while he could not pretend that their modest dividend of 3 per cent. on the ordinary stock was entirely satisfactory to the shareholders in these days of high prices, yet, looking to the reports and dividends of other railways throughout the Kingdom, he thought they must be thankful that they were able to come through so strenuous a year without any reduction of dividend, and with increased reserves.

Mr. G. D. Killey seconded, and the motion was carried.

London Electric Supply Corporation, Ltd.

Mr. R. H. Benson presided on February 25th, at Winchester House, E.C., over the annual meeting. He said that the Board felt very well satisfied with the latest year's addition to the figures, and this happy result had been accomplished simply by minding their business. Special thanks were due to the officials, beginning with Mr. Bain and Mr. Partridge, and including not merely the seniors in the department but also those juniors who had not enlisted, and who were just as useful to their country in this instance by staying at home and cheerfully doing what their hand found to do. The figures established new records in units sold, in cost of generation, and both in net and gross receipts. The gross receipts showed a rise of over £28,000, and the net had increased from £71,753 to £92,234—an increase of no less than £20,481. This in such a year was a result on which the board felt they had the right to congratulate themselves. But for the war the net revenue would have been even higher, for he need not tell them that the rise in the price of coal in the later months had affected their expenses, whilst the darkening of London at night had diminished the demand for light. The results financially justified the policy they had pursued now for a good many years of developing, and directing their chief efforts to, power supply. They had always believed that by generating current on a sufficient scale they could sell it as cheaply as any similar company in the world and make profits besides, and they claimed to have done both. They recommended a dividend on the ordinary stock of 4 per cent. instead of 3 per cent. as last year. This, he was aware, might be considered by some shareholders as ultra-conservative, but the conditions were exceptional. The war and the doubt of its duration overshadowed everything, and it affected capital as well as revenue. They could not tell what coal was going to cost them, and therefore they had got to husband their resources until the situation became clearer. Also they had got to face the situation, the solution of which was becoming more necessary, viz., that of their overspent capital account, which now amounted to over £137,000. They would remember that as long as Lord Wantage was alive he provided the money the company needed for additional plant to meet the expansion of the business, and alone shouldered other people's burdens, but since his death they had had to rely on themselves. Year by year he had had to point out that as the period of their tenure decreased as 1931 approached, so did the amount of the sinking fund increase, which was needed to extinguish fresh issues of capital. For instance, the sinking fund for the redemption of the debenture stock by 1931 demanded in cash £12,000 a year out of revenue, in addition to the sums receivable annually from their good friends and neighbours, the Westminster and St. James's Companies. This year out of surplus revenue they had allocated £7,000 to contingencies account and £10,000 to reserve, and they further increased the carry forward from £5,097 to £8,828. That was a measure of conservation prescribed by the necessities of the situation caused by the expansion of their business during wartime. He would like to draw attention to the fact that, concurrently with the large increase in the number of units sold—no less than 11,000,000—they would notice that the total generating cost per unit sold had fallen from .62d. to .5d. That was, of course, partly the direct result of the larger output, but it could not have been achieved if they had not in their engineers and staff an altogether exceptional combination of ability, zeal and goodwill, and it was a great pleasure once more to give full testimony to what the Board and the shareholders owed to those on whom the practical working of the business depended. This figure of ½d. for the cost per unit sold was actually by far the lowest reached in London, and as Mr. Bain pointed out last year, even in Chicago, where the great company sold 1,250 million units per annum, against their 46 millions, it did not equal them. So far as their company was concerned therefore, their figures demonstrated that in the area which they served London was not suffering from any lack of a cheap supply of power. That bogey, which had furnished a popular excuse for yearly attacks on the statutory terms on which electrical enterprise was undertaken, was now he hoped finally laid to rest. There was no longer any excuse for outsiders to try and get in between the County Council and the 13 companies and blandish the public with illusory promises of cheaper power. When the war was over it was to be hoped the parties interested would get together, and either under the Act of 1908, or further powers, would "associate," to use the words of the Act, to combine their plant, and so get the utmost economy in generation. For the present, the London County Council had dropped their Bill, and the ten companies, who also had a Bill, had in deference to a suggestion of the Chairman of Committees, also dropped theirs. Therefore, he need not discuss the vexed question of private enterprise compared with municipal enterprise, especially as he did so at some length last year. But he wanted to draw public attention to the solution which had lately been reached for a similar problem, after four years of violent disputes, in one of the larger and most progressive cities in America. The municipality of Kansas City had granted to the Tramway and Lighting Co., a new franchise for 30 years after or during which the undertaking was purchaseable at an agreed fixed price of 5,130 thousand dollars, plus proved capital expenditure during that period, and in the meantime, the municipality was to receive two-thirds of the net revenue remaining after providing certain capital expenditure and 6 per cent. upon the purchase price. In other words, the company got 6 per cent. upon the agreed valuation, plus one-third of the profits, and this profit-sharing of the municipality was a better bargain for the municipality than their fixed rate. America was a great country of experiment and they dashed into all sorts of things—some successful and some unsuccessful. They might in this country do worse than copy their successful experiments. It was 14 years since Lord Wantage presided over that meeting, and, although he did not live to get a dividend, yet his courage never wavered, and he had the satisfaction before his death of seeing the company in comparatively smooth waters after its costly pioneering in the effort to give the public of London a supply of electric light and power. He had told them how Lord Wantage furnished money on easy terms whenever the company needed it and they would remember that whereas their ordinary share capital was originally £555,000, they wrote off £2 of the £5 shares and reduced it to £333,000, and in that reduction Lord Wantage was the chief sufferer. In 1901, the year after his death, the total capital was £914,700, and the net revenue was £25,220. Last year the capital was £1,291,555, and the net revenue was £93,234. In other words in these 14 years their capital had increased by 41 per cent., while their net revenue had increased by 269 per cent. He need say no more to give them confidence in the company and in its ability to work out its own destiny. He did not mean to say that they could expect such a ratio of increase of net revenue this year. On the contrary, during the wartime, all companies seemed to be expecting a set-back, chiefly because of the price of coal and the diminution of lighting; but he wanted them to realise the steady progress made year by year for 14 years by the fact that net revenue had increased compared with capitalisation by 6½ to one.

Mr. R. Stewart Bain, the managing director, seconded the motion and gave as usual some interesting particulars regarding the year's work. He said the capital expenditure had amounted to £34,956, the greater portion of which had been incurred for the new 10,000-kw. turbo-generator ordered in connection with the extension of the electrification of the Brighton Railway. That plant was to have been delivered last November, but owing to the war, delivery had not yet taken place, although they were informed by the manufac-

turers that it was nearing completion. In addition, £8,600 was expended in laying several miles of new mains, particularly in connection with the supply of power for industrial purposes, which he was glad to say was extending very satisfactorily, bringing the total of mains laid to 207 miles. The expenditure was £6,861 more than last year, of which coal accounted for £5,600. As against that they sold over 11 million units more than in 1913, the consumption of coal being 73,000 tons, as compared with 62,000 for the previous year. The average price paid for coal during the year was 14s. 1d. per ton, as against 15s. 2d. in 1913, but the extra cost during the last five months of the year had added nearly 1s. a ton over the whole year. Since the beginning of this year, the price of coal had increased very materially, owing to the difficulty in getting delivery by water. During the last two months the charge for freight alone had been more than the total contract price for the delivery of the coal alongside their wharf. It had been quite an anxious time getting deliveries sufficient for their consumption. He was glad to say that up to the present they had been able to overcome those difficulties without unduly depleting their stock, although the difficulties and the price of coal were daily increasing. The gross revenue showed an increase of £28,000 over the previous year. The average price received for every unit sold—lighting and power—was .94d., as compared with 1.04d. in 1913, while the cost of production had been reduced from .62d. to a halfpenny. Their executive and technical staff had every reason to feel proud of such excellent results and they were a fine tribute to their efficiency and zeal. As far as that company was concerned, it could not be said that the district which they supplied was suffering from the want of a cheap supply of electric power, and it was doubtful whether unification of the system of supply, or amalgamations of the companies, although beneficial in other respects, would show such good results. The results compared favourably with those of any company, either in this country or abroad. Traction and power supplies again showed satisfactory increases, although the large increase of power for the extension of the electrification of the Brighton Railway, which was to have commenced this month, had had to be postponed on account of the war. In common with other companies, a considerable number of their staff had joined the colours, and in such cases the directors had agreed to keep their places open and to give them half-pay while they were absent.

Replying to questions, the Chairman said that they always made their coal contracts in the spring when, as a rule, the lowest prices were ruling, but *force majeure* had superseded all contracts. Nobody regretted more than the directors that they had not been able to pay a larger dividend, but they had only acted prudently in carrying forward £3,000 more than last year.

The report was adopted.

Westminster Electric Supply Corporation, Ltd.

Mr. J. Browne Martin presided on February 24th, at the offices, over the annual meeting. After referring to the death of Lord Suffield, the Chairman said that they had recommended a reduced dividend for the half-year. It would have been possible to pay the full 10 per cent., but this would have left them with a much smaller sum to carry forward; they could not recommend that course in view of the present situation, for the war had not only reduced receipts, but it had also increased expenses, and might possibly do so still more. The Government lighting regulations considerably reduced the sales for lighting during the last quarter of the year. Coal had increased in cost and was still going up. Carbons for street lighting cost much more than they did. They had also had to spend money on the protection of their stations. Then over 60 of their officials and men were serving with the colours, and they had promised to pay their wives or dependents half wages during the war, and to keep their places open. These half wages amounted to over £3,000 a year, which had necessitated some readjustment of duties. They had also thought it right to subscribe to the war funds. This would show them that they had had a good deal to contend with, and it was for the shareholders to judge how far they had been successful. They had not increased their charges for supply, they had maintained their full rate of depreciation, and they had only reduced the dividend for the year by one per cent. Had it not been that everyone belonging to the company had put his shoulder to the wheel such a result would have been impossible, and he was sure they would desire him to thank the staff and workmen, who were just as anxious for the success of the company as were the shareholders and directors. Their stations were watched day and night by special constables—gentlemen who had given up their time for the country, and who were patrolling outside in all sorts of weather. It was extremely tiring and monotonous work, and they would, he was sure, wish to show by a hearty vote of thanks their appreciation of what they were doing. In regard to the valuation of their investments, there was the choice of valuing them at three dates:—Dec. 31st, 1913, as the insurance companies were doing with the approval of the Board of Trade; the end of July, 1914, as the banks had done; or December 31st, 1914. The latter date would give no result of any practical value. A date just before the war would have been possible, but credit was then beginning to be shaken, and they thought that as their investments were not intended for sale it was better to follow the insurance companies. The auditors had approved of this. They had increased their investments by taking up £25,000 of the war loan. In regard to the future, the supply of coal continued to cause anxiety. Deliveries were uncertain and irregular, and prices had gone up considerably. Both electric and gas companies had represented to the Government the difficulty they were in, and something had been done lately to improve matters. But they thought it should be possible to obtain a regular supply at a reasonable rate, and felt there was room for some improvement in both these points, an improvement which only the Government could ensure as they controlled communications. With regard to carbons for street lighting, no reduction in price could be expected for some time to come, and they would have to wait until new factories could be established of sufficient output to bring down the price more nearly to that at which they had hitherto been sold by the big factories in Germany. Their expenses, therefore, were not likely to decrease during the war. Their receipts would also be reduced so long as the present lighting arrangements were necessary. The greater part of the loss was due to reduced shop lighting, but this, he was pleased to say, would not be so heavy in the summer as in the winter. They would probably have seen in the newspapers that the L.C.C. produced yet another Bill to absorb them all, but this Bill had been dropped. They also, with nine other companies, joined in promoting a Bill for forming a company to take over and utilise to the best advantage the existing resources of the companies supplying electricity in London, with a view to providing eventually one uniform system of supply. The Government had, however, decided that this Bill was contentious, and therefore could not proceed. It had consequently been withdrawn, and he need not trouble them with details.

The Rt. Hon. W. Hayes Fisher, M.P., seconded the motion.

In reply to questions raised, the Chairman said the present Bill of the L.C.C. was dropped, but he could not say that it was dropped for good. As to their company and other companies substituting another Bill for the one which the Government considered contentious, he could only say there was nothing in hand at the present time, but it was only commonsense that when ten companies came together to amalgamate for a certain purpose there should be no difficulty in getting them together again if the opportunity offered. He thought something of the kind would have to be done or otherwise the County Council would certainly interfere. They wanted an extension of life as well as amalgamation.

Mr. W. J. Fisher remarked that he had read the company's Bill carefully and he certainly saw a number of contentious points in it. If the companies, however, came together with a reasonable desire to effect consolidation that Bill might form a good basis to go on, with the contentious points eliminated.

Replying to a question by Mr. Reed as to coal, Professor Kennedy said that in the last half-year of 1914 their coal for the station at Westminster was only about 8d. a ton more than in the last half of 1913, but during the last six weeks there was an increase of something like 3s. a ton, and at Grove Road, from which they got the greater part of the supply, the increase had been on the average very considerably greater. They were adopting the policy of getting all the coal they could, and they had no reason to be anxious, but undoubtedly the prices now and in the future would be much greater. It was merely a question of getting the coals up from the collieries. The Government had put some ships at the service of the gas and electric companies, but they had hardly become useful yet, and they had to pay freights which were very high.

The report was adopted.

Tramways, Light and Power Co., Ltd.

Viscount Chilston presided over the second ordinary meeting held at 66, Queen Street, E.C., on February 25th. He said that the outbreak of the war in August had had varying effects in different localities. In some of the districts served by certain subsidiary undertakings the abnormal conditions had created an improved demand which, while not in time to reflect substantially for the year under review, would undoubtedly be an advantage for the current year. In other districts the abnormal conditions had an adverse effect, causing depression in trade, which affected the electric supply companies, and especially deterred prospective consumers from incurring any expenditure on motors and other appliances. Further, the public naturally took less advantage, since the outbreak of the war, of the facilities for travelling offered by the traction undertakings, owing to the depression. The adverse conditions affected more particularly the districts served by the Nottingham and Derbyshire Tramways Co. and the Derbyshire and Nottingham Electric Power Co. The conditions improved in the localities referred to, and since the close of the year they had evidence of a distinct recovery. The various power and light companies were large users of coal, and it was satisfactory to report that the largest user, viz., the Derbyshire and Nottinghamshire Electric Power Co., had contracted well forward at satisfactory prices. But the high price of fuel would probably operate to a certain extent to the advantage of electric supply com-

panies, because power users, and particularly small power users, would more carefully consider the use of electricity at a time when the price of coal was high. It was satisfactory to hear from the London managers, Messrs. Balfour, Beatty, Ltd., that, notwithstanding the difficult conditions of the moment, they anticipated an increase in earnings during the current year from all the properties owned by their company. So far as the year under review was concerned, the directors estimated that the outbreak of war affected the earnings to the extent of at least £3,000. A feature of all the power and light properties was that a large additional revenue could be earned from the money already expended, owing to the fact that the plant installed was sufficient to deal with a very much bigger load than at present connected, and, in addition, the cables laid were capable of serving a large number of additional consumers. The directors recommended an increase in the capital of the company to the extent of £100,000 by the creation of an additional 100,000 six per cent. cumulative preference shares of £1. He might say for the information of the shareholders that notwithstanding the number of undertakings owned by the company, they had managed, owing to the cautious policy adopted, to keep the capital expenditure, including present obligations, to within £50,000 of the amount of the original issue. They would agree that this was a very small sum spread over so many different policies, especially in view of the fact that the power undertakings covered an area of 3,000 square miles. They could, of course, deal with present requirements by issuing a portion of the unissued debentures, but this would hamper their financial arrangements in the future. It was, in their opinion, unwise to use their debenture powers to the maximum unless all development work was completed or could be provided for out of revenue. The directors had not yet decided as to what would be the most opportune time for making the issue, nor the terms. The consent of the Treasury would, of course, be required before the issue was made, but in view of the fact that the development of properties such as theirs was of material importance from the national point of view in the present crisis, not only because they supplied many different kinds of enterprises with the necessary driving power, but also provided employment for workmen, there should be no difficulty experienced in this connection. The immediate object of the capital was to repay temporary loans which had been incurred to the extent of £40,000. The directors had in contemplation the acquisition of an additional property, but shareholders could rest assured that this would only be effected if the financial arrangements were provided for, and a very satisfactory yield on the capital employed was shown. During the year the power and lighting companies had obtained four provisional orders for electric lighting—two in the area of the Derbyshire and Nottinghamshire Co., viz., the Beeston and the Heanor Orders; and two in the area of the Leicestershire and Warwickshire Power Co., viz., the Hinckley and the Kenilworth Orders. Steps had been taken to utilise the powers, and already in some districts consumers were connected.

Mr. A. R. Holland seconded the motion and it was carried.

The Chairman next proposed a resolution authorising the creation of an additional £100,000 of preference shares to rank *pari passu* with the existing shares.

Mr. G. Balfour, in seconding the motion, said that in issuing these shares, rather than taking advantage of their debenture powers, they were following the method successfully adopted by other tramway and electric lighting companies. By keeping their debentures they could meet any emergency in the way of getting additional plant.

The resolution was adopted.

Bruce Peebles & Co., Ltd.

Mr. F. E. Andrews presided at the annual meeting, held at Edinburgh, on Friday last. He said that they maintained their gradual and steady progress in the first half of 1914, and the satisfactory results shown in the accounts for the year would have shown still better improvement over those of 1913 but for the war. Theirs was essentially and entirely a purely British concern, and at the outbreak of hostilities they had not a single German, Austrian, or Hungarian in their employ. More than 150 of their men were serving with the colours, and on their return they would be reinstated in their old or similar positions. The workmen and staff had inaugurated a fund, to which the company was contributing weekly, for assisting dependents where it was required. A large proportion of the men were their best and most skilled, and their absence had of necessity caused a certain amount of difficulty in the ordinary routine of the works and offices, but the loyal efforts of those remaining at home had minimised the dislocation. The output from the works, which up to the end of July had been quite satisfactory, and better than the previous year, was naturally affected for some months afterwards by the loss of so many hands. This was being gradually overcome, though they were still suffering to some extent both from the difficulty in obtaining suitable men and from delays in getting supplies of raw materials. They had fully maintained their reputation as makers of high-class electrical machinery and had obtained a good proportion of orders, so that the works had been fairly well occupied. The prices at which these orders had been obtained had also been more reasonable than was the case two or three years ago, but the margin of profit had naturally been somewhat adversely affected by the events of the latter half of the year. In this country the company continued slowly, but very surely, to enlarge their circle of customers, especially among the better class of buyers, which was a very satisfactory sign. The Peebles-La Cour converter was being adopted by an increasing number of engineers and was also being put down in larger sizes; the largest converter made in Great Britain up to the present time had been installed and was now running at Manchester. They had all along carefully cultivated trade in the Colonies, and the results were quite satisfactory, showing a steadily increasing volume of business, though in Canada conditions had not been favourable during the last twelve-months. In various foreign countries also financial stringency or political disturbance had militated against new work being taken in hand, especially in the case of South America and China. Taking everything into consideration, however, they had no cause to be dissatisfied, and they started the new year with an amount of work sufficient to keep them well employed for some time ahead. The profit for the year from manufacturing and trading amounted to £11,649, as compared with £11,751 for 1913 and £3,864 for 1912, so that in spite of the disadvantages since August they had managed to maintain the improvement of the previous year. The net profit was £3,892, as against £2,820 a year ago. This sum went to reduce the adverse balance against profit and loss account, which therefore now stood at £17,783. Debts owing by the company were lower, as were also the debts owing to them, the latter being partly due to the fact that they were able to get somewhat better terms of payment from customers. Cash at bank, £29,084, showed an increase that was very gratifying, because a manufacturing concern such as theirs must have adequate working capital in order to carry on its business in a satisfactory manner, and further, it was essential, during the present unsettled state of industry, that the company should build up and conserve its liquid resources in order to tide over any difficult period which might arrive. Each year they spent an appreciable amount of money out of revenue for maintenance of buildings, machinery and plant, but so far they had not been able to make a suitable allowance for depreciation. This question, as well as that of goodwill, which stood in the balance sheet at over £90,000, must obviously have attention and be dealt with as soon as ever opportunity offered. After the last general meeting, Mr. Lee Murray expressed the desire, owing to his other business engagements, to retire from the board. It was scarcely necessary to remind them of the excellent work Mr. Murray did in the organisation of the company during the five years he was with them, first as general manager and afterwards as a director, and they accepted his resignation with regret. They had also lost another colleague, Mr. A. Bruce Anderson. He was an able and enthusiastic worker in the interests of the electrical manufacturing industry, and they all greatly deplored his premature and untimely death. The Chairman referred to the ability and energy of the managers, secretary, and other officials, displayed in a year that had not been without a considerable amount of worry and anxiety.

Mr. C. J. Shiells seconded the adoption of the report, which, after one or two questions had been asked and answered by the Chairman, was carried unanimously, and a hearty vote of thanks was accorded to the chairman, managers, staff, and directors.

British Insulated and Helsby Cables, Ltd.—The directors announce a final dividend, making 15 per cent. for the year, as compared with 13 per cent. for 1913. There is placed to reserve and depreciation £2,000 less than for 1913, but there is an increase of £21,000 in the amount carried forward.

British L.M. Ericsson Manufacturing Co., Ltd.—The directors recommend a dividend of 8 per cent. per annum on the ordinary shares for 1914, placing to reserve £6,000, and carrying forward £7,023.

Reduction of Capital.—Turners & Manville, Ltd., and Reduced.—A petition for confirmation of reduction of capital from £50,000 to £39,994 has been presented. Particulars of claims, &c., must be sent by March 13th to Messrs. Jackson & Co., Lower Gates, Rochdale, solicitors.

Waste Heat and Gas Electrical Generating Stations, Ltd.—The directors recommend a dividend for the year ended January, 1915, at the rate of 8 per cent. per annum, carrying forward £15,012.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted:—Electro Bleach and By-Products, Ltd.—90,200 7 per cent. participating preference shares of £1 each, fully paid, Nos. 1 to 90,200.

Western Telegraph Co., Ltd.—Second quarterly interim dividend, 3s. per share for the year ending June, 1915, being at the rate of 6% per annum.

Held Over.—Pressure upon our space compels us to hold over until next week various City reports and meetings.

Davis & Timmins, Ltd.—The net profit for 1914, including £15,083 brought forward, after allowing for depreciation and commission to manager, was £31,959. The interim dividend paid in September last on the preference shares absorbed £1,800; that on the ordinary shares at the rate of 6 per cent. per annum for the June half-year £1,410; there has been placed to general reserve account £3,000, and to income-tax account £626, leaving £25,124. Preference dividend on the 6 per cent. preference shares for the December half-year requires £1,800; a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the December half-year, making 8 per cent. per annum for the year, requires £2,350; a bonus of 12 per cent. out of profits amounts to £5,640; and £15,334 is to be carried forward. Annual meeting, March 9th.

France.—*The Société d'Electricité de Paris.*—The chairman of the Société d'Electricité de Paris, which is stated to be under the control of the Empain group of Brussels, informed the shareholders at the recent meeting that the sales in 1914 increased by 20,000,000 KW.-hours to 145,000,000 KW.-hours. After deducting depreciation amounting to £128,000 from the gross profits of £259,000, and providing for interest payments on the loans, the accounts indicate net profits of £102,000, which would permit of the distribution of 16s. on the ordinary shares and 26s. 7d. on the preference shares. It is, however, impossible to make these payments at present as the "liquid funds" are said to be locked up in Stock Exchange investments.

Jarrow and District Electric Traction Co., Ltd.—The annual meeting was held on Monday at Electrical Federation Offices, Kingsway, Mr. H. S. Day presiding. In proposing the adoption of the report, of which we gave an abstract last week, the chairman remarked that it was with much satisfaction that the directors were able to recommend the payment of a 3½ per cent. dividend for the past year, as against 2½ per cent. for 1913. The development in Jarrow was very satisfactory, and there was every reason to hope that the business of the company there would continue to be well maintained even if it did not improve. Mr. F. Cocking seconded, and the report was adopted.

Telegraph Construction and Maintenance Co., Ltd.—The directors report that the net profit for 1914 amounted to £109,186, against £114 863, after charging the interest on the debentures. To this is added £111,860 brought forward, making £221,047. An interim dividend of 5 per cent. was paid last July, and the directors recommend a further dividend of 10 per cent., together with a bonus of 12s. per share, free of tax. The reserve fund is to be supplemented by £20,000 (making it £145,000), leaving £111,407 to be carried forward.

City of London Electric Lighting Co., Ltd.—Subject to completion of audit, the directors have decided to place £50,000 to reserve and to pay 12s. per share (being at the full rate of 6 per cent. per annum) on the preference shares, and 18s. per share (being at the rate of 9 per cent. per annum) on the ordinary shares. On account of these shares 6s. per preference share and 6s. per ordinary share was paid in September, 1914. After payment of the dividend, less income-tax, and providing for other appropriations, £23,500 is to be carried forward.

Llanelly and District Electric Lighting and Traction Co., Ltd.—The accounts for 1914 show a net revenue, including £2,079 brought forward, of £12,188. After providing for loan and debenture interest, and setting aside £2,000 for depreciation and renewals, a dividend of 2 per cent. on the ordinary shares is to be paid, leaving £1,718 to carry forward. The annual meeting was held at 66, Queen Street, E.C., on February 25th, Mr. A. H. Beatty presiding. The report was adopted.

New York Telephone Co.—The report for 1914 shows net telephone earnings $16,169,660, a decline of $1,554,491; and other income, $1,869,394, an increase of $163,190. Total, $18,039,054, a decline of $1,091,301. Interest charges have absorbed $4,027,132, an increase of $448,317; while dividends have taken $10,008,579, a decline of $220, leaving balance to surplus and reserves $4,003,343, a decrease of $1,539,398.—*Financial Times.*

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit the directors recommend a final dividend payable on March 19th on the ordinary shares of 10 per cent. less income-tax, making 15 per cent. for the year, and a bonus of 5s. per share less income-tax. For 1913 the distribution was 20 per cent.

STOCKS AND SHARES.

Tuesday Evening.

Present days are mostly unexciting in Stock Exchange circles. It is as though people had said to themselves that they would do nothing until the war gave indication of further developments. The best news received for some time past was that dealing with the passage of the Dardanelles, which had a distinctly cheering effect upon spirits, but failed to have any effect upon prices. Definite news of the fall of Constantinople would probably have a stimulating effect; but until something of this sort arrives, investment stays its hand.

Each new issue as it appears has to be rather more attractive than its predecessor. The Treasury is putting very little obstacle in the way of new emissions; and any company which can show that it requires capital in order to provide employés with work, especially if directly or indirectly connected with Government contracts, need have little hesitation in applying for powers to raise money. At the same time, the Treasury restrictions upon Stock Exchange dealing continue to be so severe that borrowers delay making appeals to the public until they are obliged to do so.

The Home Railway market is obsessed by the latest labour fears. Through the curt intervention of the Government, immediate difficulties are bridged over; but such an erection will be only temporary, and the whole question will be revived in a more acute form later on. Londoners in particular are inclined to look at the labour agitations as reflecting gravely upon the patriotism of those responsible for the trouble; and the plain man in the street wonders how on earth any compatriot of his can so deliberately throw in his lot with the enemy as to participate in these disturbances before exhausting every conceivable means for settling debateable points peaceably.

Therefore Metropolitans have gone back to 28¾, Districts to 17¼, Central London ordinary to 76, while the tone of the market as a whole is drab. Two or three of the big steam stocks are raising more capital, but we have heard no proposals of this sort in connection with the electric lines. As a point of curiosity, it may be mentioned that Metropolitan Consolidated, South Eastern deferred and South Western deferred all stand about the same price, although the dividends recently declared were 1¼, 1, and 1⅛ respectively. Underground Electric income bonds are ex the dividend of £3 per cent.; at the current price of 80, the return on the money is exactly 7½ per cent., paid free of income tax.

The prophets who foretold a reduction of about 1 per cent. in the City of London Electric dividend have proved correct, and the company is now paying 18s. per share—that is, 9 per cent.—against £1 per share, equal to 10 per cent., last year. The County of London maintained its previous dividend, and County preference shares have been a firm market for some time past. Curiously enough, it is difficult to obtain an adequate bid for the ordinary shares. City Lights keep about 14¼, with an occasional bargain transacted in them. The Charing Cross Co. announces that the profits on its City undertaking advanced during the last financial year, but its West End receipts fell off by nearly £10,000. Mild interest is taken in the course of the London Electricity Supply Bill No. 2; as to the chance of its successful passage through the House of Commons, opinion has been already ventured here.

So far, all the electric lighting companies have announced their dividends, with the exception of the Brompton. Summarised, the results are that the St. James' pays 2 per cent. less than it did a year ago, the City of London, the Charing Cross, Metropolitan, and the Westminster 1 per cent. less, Smithfield Markets ½ per cent. less, Kensington, Notting Hill and County the same, and the London 1 per cent. more. All things considered, the achievements may be fairly regarded as good. Prices on the week show small falls in Brompton ordinary, Charing Cross preference, and Westminster preference. St. James' recovered their dividend of 5s., and County preference are also 5s. higher at 11¼.

We append our usual list of representative stocks and shares:—

	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Home Electricity Companies.			
Brompton Ordinary	9⅛	8⅞	– ¼
do. 7 per cent. Pref.	8⅝	8⅝	–
Charing Cross Ordinary	5¼	4¾	–
do. do. do. 4½ Pref.	4¾	4	– ½
do. do. City Pref.	4⅜	4	–
do. 4 Deb.	91½	90	–
Chelsea	4⅞	4⅞	–
do. 4½ Deb.	96½	92	–
City of London	16	14¼	–
do. do. 6 per cent. Pref.	13½	12½	–
do. do. 5 Deb.	116½	112	–
do. do. 4½ Deb.	100¼	98	–
County of London	12	11	–
do. do. 6 per cent. Pref.	12	11¼	+ ¼
do. do. 1st Deb.	102½	99	–
do. do. 2nd Deb.	100⅝	97	–
Kensington Ordinary	7¾	7½	–
London Electric	1 7/16	1⅜	–
do. do. 6 per cent. Pref.	5 7/16	5⅜	–
do. do. 4 Deb.	92½	87	–
Metropolitan	3¼	3⅛	–
do. 4½ per cent. Pref.	4 7/16	4	–
do. 4½ Deb.	97⅛	96	–
do. 3½ Deb.	83	80	–
St. James' and Pall Mall	9⅜	9 xd	+ ¼
do. do. do. 7 per cent. Pref.	7	6¾	–
do. do. do. 3½ Deb.	84½	80	–
South London	3 1/16	3	–
South Metropolitan Pref.	1⅝	1⅝	–
Westminster Ordinary	8⅜	8 xd	–
do. 4½ Pref.	5⅜	4¾	– ⅛
Home Rails.			
Central London, Ord. Assented	83	76	–1
Metropolitan	97½	28¾	– ½
do. District	21½	17¼	– ¼
Underground Electric Ordinary	2⅜	1⅞	–
do. "A"	7/8	6/-	–
do. Income	88	79½ xd	– ½

Telegraphs and Telephones.	Mean price. July 27, 1914.	Mar. 2, 1915.	Rise or fall this week.
Anglo-Am. Tel. Pf.	108¼	104 xd	—
do. Def.	23	21⅞ xd	— ⅜
Chile Telephone	7⅜	6⅞	— ⅛
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	12½	—
Eastern Extension	12⅝	12⅝	—
do. 4 Deb.	97½	92 xd	—
Eastern Tel. Ord.	130½	127	—
do. 3½ Pf.	77½	73	+1
do. 4 Deb.	96½	94	—
Globe Tel. and T. Ord.	11¼	10⅜	—
do. Pf.	12⅝	11½	— ¼
Gt. Northern Tel.	32½	28	—
Indo-European	59	51	—4
Marconi	1⅞	1⅜	—
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2 5/32	2	—
do. Pf.	1 3/32	1 1/16	—
Tel. Egypt Deb.	98	88⅔	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1½	1 5/16	—
Western Telegraph	13⅜	13	—
do. 4 Deb.	96½	95½	—
Foreign Trams, &c.			
Anglo-Arg. Trams, First Pf.	4⅞	4½	+ ⅛
do. 2nd Pf.	4¼	4	—
do. 4 Deb.	91	84	—
do. 4½ Deb.	98⅓	93	—
do. 5 Deb.	96	88	—
Brazil Tractions	66	51	+1½
Bombay Electric Pf.	11⅜	10⅜ xd	—
do. 4½ Deb.	96	91	—
Mexico Trams	70	35	—
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	40	—10
Adelaide Sup. 6 per cent. Pf.	6½	5⅝ xd	+ 1/16
do. 5 Deb.	104	103	+1
Manufacturing Companies.			
British Westinghouse Pref.	1⅞	1 15/16	—
do. 4 Deb.	74½	72	—
do. 6 p. lien	102½	99	+ ½
Callenders	11½	11⅜	—
do. 5 Pref.	5⅛	4⅞	—
do. 4½ Deb.	98½	98	—
Castner-Kellner	2⅛	3 3/16	— 1/16
Edison & Swan, £3 pd.	3 3/32	11/6	—
do. do. fully paid	1½	2	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63½	60	—
Electric Construction	1 3/32	13/-	—
do. do. Pf.	1/8	1	—
Gen. Elec. Pf.	10⅜	10	—
Henleys	15	14	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8 3/32	+ 1/32
Telegraph Con.	38½	37	—

In the foreign group, Anglo-Argentine Trams 1st preference recovered to 4½, so wiping out their loss of last week. Brazil Tractions at 51 are 1½ higher, on improvement in the Rio exchange. Mexico Trams are a dull and weak market. The 6 per cent. 2nd bonds at 40 are nominally 10 points lower, though what a holder would get, if he wished to sell at the present time, it is difficult to say. The company has just notified that it has no alternative but to defer payment of interest on its bonds in consequence of the action of the Mexican "Government" (inverted commas are ours). Representations have been made to the Government and the United States Government on behalf of the company. Adelaide Supply Debenture stock is better at 103. The Manila Electric Railroad has declared its usual dividend of 1½ per cent. for the quarter ended March 31st last.

The Telegraph Construction Co. maintains its dividend of 20 per cent. free of tax, in spite of a small falling-off in the nett profit for the year; actually, the difference in the disposable balance is the bagatelle of £500, while the reserve fund has been again strengthened by the addition of £20,000. Shares changed hands to-day (Tuesday) at 36⅝ and 37¼. British Westinghouse 4 per cent. debenture stock is changing hands on the basis of 72; and a fairly active market is established in British Aluminium ordinary at 24s. Castner-Kellners have gone back a trifle to 3 3-16. India Rubber shares at 8⅜ are 5s. higher, on an enquiry which found no ficating supply of shares.

The Telegraph market is very quiet. The feature is a sharp fall in Indo-European shares, which dropped to 51 on the appearance of a small seller. Previously the price had been supposed to stand at 55. Chili Telephones keep dull, and a further fall of ⅛ has occurred. Anglo-American Telegraph deferred eased off ⅜, most securities connected with the United States being somewhat depressed in consequence of the strained international situation. It will be noticed that we have deleted Constantinople Telephones from our list, for the simple reason that there is no market in the shares at the present juncture and that any sort of a quotation at all is at the moment merely guesswork.

War or no war, Henley's profits flow the same way as Tennyson's brook. In declaring a final dividend of 10 per cent. for 1914, with a bonus of 5s. per share, the directors repeat the previous distribution, which was 5 per cent. better than the dividend declared first in 1903, and paid regularly up to 1912 inclusive. In twelve years, therefore, the ordinary shareholders have received 190 per cent.; and if we include one year earlier, when the distribution was also 20 per cent., they will have got their capital back more than twice over in the space of thirteen years—a remarkable achievement for any industrial concern. The company celebrates its thirty-fifth birthday this year. In 1902, just before reduction of the dividend, the £5 shares rose to 19; the lowest they have been since is 9½, in 1905, while in the war crisis of last autumn they never fell below 13. At the present price of 14, the return on the money is 7½ per cent., allowing for the dividend now included in the price.

The principal feature in the raw rubber market is the practical wiping out of the premium on the Pará product, plantation and wild rubber being now virtually the same price. Since the removal of the Government's embargo upon imports of rubber, as it related to the United States, stocks have shown a decided disposition to decrease; and as trade conditions become more and more normal in America, so will the demand for rubber expand, while Japan is also taking substantial quantities. The share market is quiet and steady, without exceptional movements. The armament group improved on the news from the Dardanelles. In which connection, it may be remarked that the outstanding feature is a rise to 15s. in the one shilling shares of the Projectile (1902) Co. Before war broke out, they were about eighteenpence apiece, and almost as unsaleable then as they are difficult to buy now.

MARKET QUOTATIONS.

Owing to the war, the prices given below are, of course, more or less nominal.

Wednesday, March 3rd.

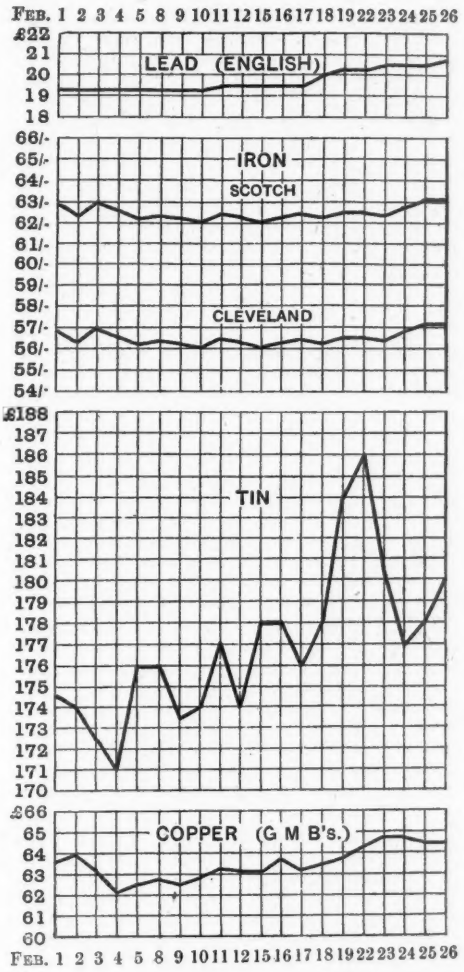
CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	4/6	..
a „ Nitric	„	19/-	..
a „ Oxalic	per lb.	8d.	..
a „ Sulphuric	per cwt.	5/-	..
a Ammoniac Sal	„	£49	..
a Ammonia, Muriate (large crystal)	per ton	£49	..
a Bleaching powder	„	£8 10	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£18 10	..
a Copper Sulphate	„	£27 10	£1 10 inc.
a Lead, Nitrate	„	£35	..
a „ White Sugar	„	..	..
a „ Peroxide	„	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	6d.	..
a Potash, Caustic (88/90 %)	per ton	..	..
a „ Chlorate	per lb.	1/4	..
a „ Perchlorate	„	1/-	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£5 10	..
a Sulphur, Sublimed Flowers	„	£11 10	..
a „ Recovered	„	£8	..
a „ Lump	„	£8 10	..
a Soda, Caustic (white 70/72 %)	„	£10 2 6	..
a „ Chlorate	per lb.	8½d.	..
a „ Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	8¼d.	..
METALS, &c.			
Aluminium Ingots, in ton lots	per ton	£85	..
„ Wire, in ton lots (1 to 14 S.W.G.)	„	£112	..
b „ Sheet, in ton lots	„	£113	..
p Babbitt's metal ingots	„	£50 to £221	..
c Brass (rolled metal 2' to 12' basis)	per lb.	9½d.	½d. inc.
c „ Tube (brazed)	„	10½d.	½d. inc.
c „ „ (solid drawn)	„	10d.	½d. inc.
c „ Wire, basis	„	9½d.	½d. inc.
c Copper Tubes (brazed)	„	11½d.	½d. inc.
c „ „ (solid drawn)	„	11½d.	½d. inc.
g „ Bars (best selected)	per ton	£86	£2 inc.
g „ Sheet	„	£86	£2 inc.
g „ Rod	„	£86	£2 inc.
d „ (Electrolytic) Bars	„	£70	£1 5 inc.
d „ „ Sheets	„	£88	£1 5 inc.
d „ „ Rods	„	£76	£1 5 inc.
d „ „ H.C. Wire	per lb.	9¾d.	1/32 inc.
f Ebonite Rod	„	8/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	1/8	..
h Gutta-percha, fine	„	6/10	..
h India-rubber, Para fine	„	2/5	1d. dec.
l Iron Pig (Cleveland warrants)	per ton	56/10	8d. inc.
l „ Wire, galv. No. 8, P.O. qual.	„	£17	£1 inc.
g Lead, English Pig	„	£20 10 to £20 15	10/- to 25/- in.
m Manganin Wire No. 28	per lb.	..	..
g Mercury	per bot.	£12 10 to £12 15	5/- to 10/- in.
e Mica (in original cases) small	per lb.	4d. to 2/6	..
e „ „ „ medium	„	3/- to 5/-	..
e „ „ „ large	„	6/6 to 10/6 & up.	..
o Nickel, sheet, wire, &c.	„	Nom.	..
p Phosphor Bronze, plain castings	„	1/1 to 1/3½	..
p „ „ rolled bars & rods	„	1/2 to 1/8½	½d. inc.
p „ „ rolled strip & sheet	„	1/3½ to 1/6½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel, Magnet, in bars	per ton	£70	..
g Tin, Block (English)	„	£176 to £180	..
n „ Wire, Nos. 1 to 16	per lb.	2/5	1d. inc.
p White Anti-friction Metals	per ton	£52 to £194	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

METAL MARKET.

Fluctuations in February.



Soldering Aluminium.—The last New Zealand mail brings some brief particulars of a new process of soldering aluminium, which has been devised by Mr. W. Overend, a partner of Mr. H. Grinlinton, a cycle importer and manufacturer, of Auckland. It is stated that by the process aluminium can be soldered not only to itself, but also to any other metal, including cast-iron and steel, and also to carbon. It is added that the Auckland Tramways Co. has given Mr. Overend an opportunity of applying his process, and that the New Zealand Government has placed an experimental order for 100 aluminium terminals soldered direct on to carbons.

Foreign Concessions in Norway.—It is reported from Christiania that the Council of State has adopted a Bill in regard to waterfalls, mines and other land property, which proposes the introduction of considerably more severe conditions with respect to the grant of concessions, particularly to foreigners, than those contained in the law of September 18th, 1909. In the case of waterfalls, a distinction is drawn between Norwegian companies and companies with foreign capital. Under the Bill the latter are to receive a concession in future only under special circumstances; and the greatest caution is to be exercised in this respect. The maximum period of a concession is to be reduced to 60 years, although in an exceptional case it may be prolonged to 70 years with the consent of the Storthing. On the expiration of the concession the power station and machinery and accessories, together with the workmen's dwellings, are to pass into the possession of the State free of charge. It would, however, be possible for the State in the first place to purchase the undertaking forming the concession at the end of 40 years, or for the local authorities concerned to do so in the event of the State taking no action in the matter. The Bill further provides for the headquarters of the company to be located in Norway, and for the majority of the shareholders to be Norwegian subjects. It is stated that if the Bill were passed by the Storthing, foreign capital would probably no longer come into consideration in connection with waterfalls in Norway, and the regulations proposed for the latter would also apply to mines, &c.

TRAINING FOR THE INDUSTRIAL SIDE OF ENGINEERING.

By A. P. M. FLEMING, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, February 23rd,* 1915.)

In the manufacture of engineering apparatus keen competition has directed increased attention to every factor affecting economic production. Labour is one of the most important of these factors, and the object of this paper is to discuss the requirements of training for the various grades of employment in the manufacturing industry and the lines on which such training can most effectively be carried out. In this country, while a great deal of attention has been paid to the training of the technically-educated man, comparatively little has been done to provide the best possible training for youths who are to become skilled workmen.

The grades of employment to be considered may be divided into two classes, namely, those of a non-technical character, and those for which technical training is essential.

Preparation for "non-technical" positions, in so far as it is made at all in this country, is by means of "trade" apprenticeship, for which youths enter works straight from school at the age of from 14 to 16, and are "bound" to a trade until the age of 21. For the "technical" positions many works provide a special practical course, which may be termed "engineering" apprenticeship, the purpose of which is to afford a broad experience in manufacturing processes and methods rather than a high degree of manual skill.

To secure the greatest gain, both to the individual firm and to the industry as a whole, it is important to aim at training each youth so as to develop to the utmost his latent ability, and to prepare him most expeditiously for the position for which his education and ability fit him. While it is important to provide facilities for the able youth to rise from the ranks to a technical position, it is an error to assume that every trade apprentice is capable of so doing and to direct educational efforts solely to that end. The majority of such apprentices will work at the bench all their lives, and their training should consequently be such as to fit them for this sphere.

Non-technical Employment.

The ordinary workmen comprise three main classes: (a) the craftsman or skilled workman, (b) the specialist, and (c) the unskilled labourer.

The craftsman and specialist require quite different knowledge and characteristics. The former needs to concentrate considerable thought upon his work, to possess initiative, delicacy of touch, co-ordination between hand and eye in a marked degree, a knowledge of drawing, a thorough experience of his craft, and a sufficient general knowledge to appreciate the importance and function of his efforts in the whole series of operations bringing about the conversion of raw material to the finished product.

The specialist, on the other hand, mainly requires manual skill in a single operation, or dexterity in operating a machine-tool, and the ability to carry out repetition work continuously without diminution in productive capacity.

Sub-division and specialisation in methods of manufacture, and the introduction of machine tools, enable many processes to be carried out by the specialist which originally required the employment of a craftsman, with the result that employers have found it advantageous to exploit juvenile labour on a limited range of work rather than train it for the future supply of skilled workmen and for the ultimate benefit of the industry.

While the problem of devising some satisfactory means for determining the vocational fitness of a youth is engaging considerable attention, the efforts hitherto applied appear to have resulted in very little practical benefit to the engineering trades. In this connection teachers who are in daily contact with youths in the elementary schools could render much assistance by observing those likely to be suited for skilled handicrafts. If observation is supported by a first-hand knowledge on the part of the teacher of the requirements of the trade and of its scope and possibilities, a latent desire for such a vocation might be developed and fostered in the student.

In a number of institutions, recognised by the Board of Education as Junior Technical Schools, pre-apprenticeship training is provided. This includes some bench-work in metals and wood, and instruction in drawing and elementary engineering theory. The courses thus provided are excellent in their way, but the facilities provided by these schools for teaching youths likely to become skilled workmen are insufficient for the requirements of the industry. There is need for the provision in every industrial centre of accommodation for a sufficient number of youths to supply local engineering works, and means for affording suitable preparatory education.

Under present conditions the chance of a youth entering a skilled trade because of his vocational fitness is so haphazard that organised efforts are necessary to ensure the proper selection of youths. No vocation affords such possibilities of secure employment, coupled with unlimited opportunities of advancement, as that of the engineering trades, and it is

reasonable to direct to such a vocation the youth possessing the soundest character, best physique, and greatest intelligence.

Under modern conditions a great deal of the apprenticeship period is liable to be inefficiently utilised, and even in those works where special efforts are made to teach manual operations correctly, there is a great deal of trade knowledge of importance to an apprentice which he is unable to obtain readily in the shops.

Suitable training comprises two phases, namely, practical experience in the processes and materials pertaining to the craft, and trade instruction, *i.e.*, a knowledge of the principles underlying the methods and processes employed and of such applications of science as bear on the trade. The former can only be acquired satisfactorily in the shops, provided the apprentice is not looked upon merely as a producing unit and that systematic means are taken to teach him the manual operations of his craft. Trade instruction can best be dealt with quite separately on the lines suggested later.

In most engineering works no special facilities are provided for practical training, and an apprentice has usually to pick up such experience as he can in a more or less haphazard fashion. In some works instructors are employed, and in others a separate training shop is provided. An example in this country is the training shop for instrument makers provided in Mr. Robert Paul's works in London.

The instruction that an apprentice receives during his period of training should be directed primarily to bear on his trade. In most industrial centres, however, the only instruction available is that afforded by evening technical classes, and this, while providing an excellent means by which the ambitious youth can fit himself for technical employment, is usually of little or no assistance to the youth who is to be a workman all his life. Moreover, in most firms it is not compulsory for an apprentice to pursue a course of evening instruction.

In the case of youths who have had suitable pre-apprenticeship education, instruction should comprise the processes applying to the trades and the principles underlying them; the names, description, preparation and uses of the tools and appliances; how to read drawings and diagrams; the physical properties of the materials employed; the cost of the apparatus produced in the trade; the importance of avoiding waste of time, effort, and materials, and the function of the apparatus or parts manufactured.

It is important that the instruction be so imparted as to stimulate the youth's ambition to attain higher skill, to take pride in his work, and to develop his latent powers of dexterity in workmanship to the utmost. Such trade teaching can be imparted by oral and written means; and this method possesses the important effect of developing a youth's ability to acquire knowledge from other sources than his own personal experience.

In Germany vocational training is made an important feature of compulsory continuation education. Youths are permitted to leave school at the age of 14, but must continue with their education for about eight hours per week throughout the period of apprenticeship, for the most part during working hours. At Munich, around which there are a number of comparatively small industrial works, separate classes are arranged for the youths of each trade, and apart from the continuation of general education, both practical and theoretical instruction is given in the trade by skilled workmen and special instructors. In the larger industries in Northern Germany it is more usual for an apprentice school to be provided in each works, or collectively for several works; such schools are recognised by the State, and their students are exempted from compulsory continuation school studies.

Apprenticeship in engineering trades extends over a period of four years, and at the end of this time an apprentice is required to present himself before a committee of experts who examine his knowledge of the trade, and to whom he has to submit a specimen of his workmanship. Successful apprentices secure a master's certificate, and an employer is not allowed to have apprentices unless their training is supervised by one of his staff who possesses this certificate.

The importance and number of apprentice schools attached to individual works is increasing considerably, and the results obtained appear to be in every way satisfactory.

In Switzerland, continuation education of youths embodying trade instruction is carried out on a plan similar to that in Germany.

A typical example of complete apprentice training carried out entirely in school, is that of the Skiensfjorden's Mechanical School at Porsgrund, Norway. Here about 160 youths are given trade instruction and practical training during a 3-year course, part of each day being spent in class and part in school workshops. The results are said to be eminently satisfactory.

In France and the United States there is as yet no national scheme for the vocational training of juvenile workers, although much has been done in this direction by individual employers in various industries. In some of the trade schools youths attend classes on alternate weeks, and in this way disorganisation and loss due to stoppage of machine tools is avoided. Apprentice schools have been established in many of the large engineering works.

In companies such as the Westinghouse and General Electric, most of the practical experience is gained in a special training shop. In the former company a youth spends about six months in the training shop learning the use of one particular tool or process, and then proceeds to the main shop, where he does similar work under commercial conditions. He subsequently returns to the apprentice school and learns the use of another tool or process, and so on till the end of his apprenticeship. Throughout this time he attends class instruction during a certain number of hours per week.

In the General Electric Company the apprentice spends all his time of training either in class or in the training shop. In the latter he is moved progressively from machine to machine, his proficiency being gauged by when he is able efficiently to "break in" the youth who succeeds him. A 4-year period of apprenticeship is becoming customary in the largest works.

During the past few years considerable interest has been taken in the development of the apprentice-school method of training, and most of the large works in every kind of industry are adopting this plan.

In the various industrial countries that have been considered, the combination of practical training either in works or in special training shops and of trade teaching in class is that most favoured for the training of workmen. The apprentice school attached to works represents the simplest and most efficient means of applying this principle. Apprentices work in the shops under commercial conditions for a part of each day, and attend school during certain of the working hours. This method of training affords the most flexible means of dealing with special features peculiar to individual works. The close supervision possible in an apprenticeship school enables those apprentices deserving of promotion to be readily selected. In this way the interest of the remainder is increased, and a spirit of emulation is aroused.

The apprentice-school method of instruction has been adopted by the British Westinghouse Company. Instruction averaging about five hours per week is given during working hours to all "bound" apprentices, numbering altogether about 300, in a school situated in the works. The regular rate of wages is paid during the time spent in study, and all the cost of books and stationery is borne by the firm. The teaching is done by twelve members of the firm's engineering staff, supplemented by lectures from the leading foremen and shop engineers, which deal specially with the trade subjects. The contact between the foremen and apprentices in the school produces excellent results, and removes the diffidence which many of the apprentices feel in approaching the foremen with their difficulties. Where it is required to illustrate special processes or describe particular apparatus, which cannot readily be done in the school by lantern projection or drawings, practical demonstrations are given in the works.

The most promising of the apprentices are selected for work in the testing departments and drawing office, and in other respects are allowed a wider range of work than that covered by their own trade. Each year about ten apprentices are selected as a result of their school work and shop progress, and sent for one whole day each week to the course for engineering apprentices at the Manchester Municipal School of Technology. The cost of tuition, books, etc., is borne by the firm, and no deduction is made from wages during the time spent at the school. Such youths are marked for advancement in the company's service as suitable opportunities occur.

Through their work in the school the interest of the foremen is aroused, and as a result increased attention is paid by them in the shops to the practical training of apprentices.

This apprentice school has only been in operation for about a year, but so far the results both from the point of the company of of the apprentices are most encouraging.

While the primary function of the apprentice school is to prepare youths to become good workmen, its secondary object is to enable a selection to be made of promising youths for promotion to positions where they can be more advantageously employed, as, for instance, charge hands, foremen, and inspectors. In addition to such positions, the apprentice school affords a ready means of selecting apprentices who can profit by technical training and rise to higher posts. The provision of a channel whereby an apprentice can rise from non-technical to technical employment is a most desirable feature, and should be given every encouragement.

Technical Employment.

A technically-trained engineer who enters a manufacturer's works and intends to remain in that branch of the industry requires quite different training from that of one who ultimately expects to take up, for example, civil engineering, operating work, or the broader scope met with in colonial engineering.

The various kinds of technical employment in engineering manufacture are as follows:—

(1) The works side, including such positions as works and departmental managers, shop engineers, leading foremen, assistants in the inspection, testing, estimating, and drafting departments.

(2) Designers.

(3) Commercial engineers.

The works side affords an increasing scope for technically-trained men possessing a bent for organisation, and in whom can be developed the capacity for handling labour and directing manufacturing processes. Such young men, after serving an apprenticeship, should take up junior positions in the works, where they can acquire the further experience and knowledge necessary for economic production.

At the present time most young men on leaving a technical

school have a knowledge only of the field of employment offered by design and commercial work, and fail entirely to recognise the importance and possibilities of executive positions in the works. Added to this, there is a feeling that the works and office staffs are of quite a different status—an idea that needs to be vigorously dispelled.

The possibilities of effecting economies in the shops justify the employment there of young men of the best intelligence available in a manufacturing organisation. In this connection there is a growing tendency in large works—and one of which full advantage has been taken on the Continent—to employ shop engineers, whose function it is to supervise technical details and processes, to follow up new designs throughout the various stages of manufacture, to investigate troubles and hitches wherever they occur, to devise economic methods of manufacture, and where necessary to alter existing designs so as to enable the most economic and up-to-date methods of manufacture to be employed. Shop engineers require good technical training, suitable shop practice, and drawing-office experience.

Apart from these positions, important vacancies in the estimating department should be filled by technically-trained men who have an intelligent understanding of works processes. Such men are in a position to detect leakages and determine where economies in working can be effected, which are likely to be overlooked if ordinary clerical labour is employed. In the testing department the leading men should also have good technical training. This department is the backbone of the designing office, and scientifically-trained intelligence there is invaluable.

For the design branch, scientific training is indispensable, and a great many technically-trained students look to it for their future employment. It is not sufficiently realised that for such work thorough practical experience in the shops, including an intimate knowledge of manufacturing costs and processes, is invaluable. Works experience is essential in developing the intuitive capacity which seems to be a particularly marked characteristic of British engineers, and too much attention cannot be paid to this phase of training.

The need for really well-trained engineers for the commercial side is becoming more and more appreciated by manufacturers. Sound technical knowledge and a considerable amount of practical training are indispensable, especially in the many-sided electrical industry.

Of the various plans of training for technical positions, the following are those most common:—

(*a*) By a trade apprenticeship combined with evening or part-time study. This method is particularly applicable to manufacturing.

(*b*) By a short period in works, then a college course, followed by works apprenticeship. This plan is recommended by the Institution of Civil Engineers.

(*c*) By taking a complete college and then a works course.

(*d*) By sandwiching college and works training in varying periods.

(*e*) By taking a complete works apprenticeship prior to the technical training. This is not a satisfactory method for training for technical positions in manufacturing.

Of these plans, (*a*), (*b*) and (*c*) are most suitable from the manufacturer's point of view; but whichever method is adopted, it is desirable that the practical training should terminate in the works, since a better opportunity is afforded to the student for obtaining permanent employment with the firm in which he has obtained his training. It is also most important that the entire training be preceded by thoroughly sound general education.

There is a wide diversity of opinion as to how long a period of practical training a technically-educated young man should have, and what its nature should be. Some firms adhere to the 5-year apprenticeship scheme as applying to all young men, whether they are being trained as workmen or for technical positions, but the more modern tendency is to arrange a shortened course for the latter. While long practical experience is excellent, it is not the most effective method of attaining the end in view. Moreover, a man who has had his intelligence developed by a technical-college course should be able to acquire practical experience at a much quicker rate than one not so educated. The object is to afford an insight into manufacturing methods and economics, and to acquire a knowledge of how to handle men.

In addition to the arrangements for training "trades" apprentices already described, the British Westinghouse Company has for the past twelve years trained "engineering" apprentices according to certain well-defined courses.

Young men of the age of 20 and upwards, who have had a thorough scientific training at a University and possess an Honours engineering degree or are in other respects considered eligible, are admitted to a 2-year course of apprenticeship on the recommendation of their college authorities. Young men of from 18 to 20 who have had a good technical education are apprenticed for three years.

In addition to the manufacturing departments, the apprentices have opportunities for entering the testing, drawing-office, designing, and commercial departments. They are moved from department to department, as a rule every few months, and every endeavour is made to develop the apprentice's capacity by giving him responsible work to do. The first six months of apprenticeship are served on probation.

The object of these courses is to train suitable young men for the company's service in either the works or design departments, or in the commercial sections of the organisation at home and abroad. Prior to the end of their course of training apprentices are usually placed in one or more staff positions on trial.

Heretofore, during apprenticeship, only a nominal rate of wages has been paid. Owing, however, to the fact that many promising young men have on this account been debarred from undertaking practical training, a rate of wage is now paid to suitable men which is sufficient to render them self-supporting during their period of apprenticeship.

Candidates for apprenticeship are selected strictly on merit, and are discharged during the probationary period if found to be unsatisfactory. There are as a rule about 100 "engineering" apprentices at all times in course of training, and the results of this plan of training have on the whole been excellent.

From the foregoing considerations, the need for a clearly-defined plan of training youths for manufacturing employment is evident, and the importance of the subject justifies concerted steps being taken by manufacturers to plan the most suitable means of training, and as far as possible to ensure uniformity of action by all employers.

Special pre-apprenticeship instruction is desirable. The function of the subsequent training is two-fold. One is to select those youths who possess the ability to profit by technical instruction, and to provide for such youths facilities for their advancement to positions where their capabilities may be fully utilised. The other is to train youths lacking in such ability so as best to fulfil their function as workmen. In the efficient training of the latter two requirements must be provided—manual experience and trade instruction.

With regard to trade instruction, the evening technical classes available in most industrial centres are quite unsuitable. Such education should be made directly applicable to the trades of the district, and apprentices should be compelled by their employers to attend classes for suitable instruction, which should preferably be arranged during the daytime.

The apprentice-school method of training offers many advantages, and the author is of the opinion that in this method will be found the solution of a great many of the difficulties connected with apprentice training.

As regards "engineering" apprentices, it is not so important that the training be arranged on such uniform lines in different works as in the case of trade apprentices.

Attention is directed to the value of scientifically-trained men in works organisation, and to the fact that except in isolated cases the technical colleges have neglected to give attention to this field of employment.

In connection with the training for all positions whether of a technical or non-technical character, the importance of securing the best possible material cannot be over-emphasised, and it is a short-sighted policy for employers to place any obstacle such as financial restrictions in the way of admitting promising young men to the industry.

As to the economic importance of training apprentices, money and service thus expended may be viewed in the light of an investment. Individual employers reap direct benefit due to the fact that trade apprentices, as a result of careful training, mature at an earlier age than those not so trained. Also, owing to their ability to read drawings and make shop calculations, they require less supervision and assistance from their foremen.

As to the industry generally, improved labour would have a favourable influence in international competition. The development of each worker to his greatest efficiency and usefulness would be a national gain.

THE ELECTRICAL EQUIPMENT OF A COUNTRY HOUSE.

By FREDERIC H. TAYLOR, A.M.I.E.E.

(*Abstract of paper read before the* Junior Institution of Engineers *on February 19th*, 1915.)

The importance of the electrical equipment of a country house can hardly be over-rated. Although perhaps the greatest duty entrusted to electricity in the house is lighting, it is called into service over many others, such as: heating, motor drives for domestic machinery, electric bells and telephones.

Plants operated by paraffin engines represent by far the largest part of the installations of the last few years. They are obtainable from 1 to about 12 kw., by a host of makers, and generally are very reliable in character. The paraffin-electric set, together with the use of metal filament lamps, has entirely revolutionised country house lighting, both as regards prime cost and running cost. Such a plant can be put into the hands of unskilled labour and yet be relied upon to give satisfactory results.

Many people urge that the most economical voltage to employ, except for large houses, is 25 or 50, but 10-watt 100-volt lamps with a satisfactory life can now be obtained, and cases where 50 volts is to be preferred are now few in number. Where current is required for heating, or motor driving, 100 volts becomes virtually a necessity.

The complete plant consists of a paraffin engine, coupled to a dynamo, the engine being started up on petrol, and afterwards switched over on to paraffin. For a small set giving only 3½ to 4 kilowatts, such as one would use for a house containing about 140 lights, a consumption as low as 1.6 pints of paraffin per kilowatt-hour can readily be had. In a case now before me of this size the cost for fuel will work out at something like 5s. per week during the winter months. The dynamo is almost exclusively used for charging a battery of accumulators. When a new house is to be built the space allotted for the electric plant is usually of the very smallest possible dimensions. The placing of a plant in a very confined space cannot produce the greatest efficiency of working.

Another common mistake in the lay-out consists in the connection between the engine room and battery room by means of the main switchboard. Many electric contractors and architects have a hole left in the wall which divides the engine room from the battery room, the main switchboard being recessed into this. Two results may follow. One is that the acid fumes from the battery have free access to all the bare copper and brass connections of the switchboard, and the other is that, with a view to meeting this point, the back of the switchboard is sometimes boxed in with woodwork so as to form a shallow cupboard, to receive later on various odds and ends, and thus provide a good opportunity for fire.

However small the plant may be, the switchboard should be kept absolutely in the engine room with a clear 18 in. space at the back. The battery stands are often only made about 18 in. high, the result being that the cells rarely get properly examined. Preferably, the cells should be on a stand of a height to allow for convenient and ready inspection, say, 2 ft. 6 in. to 3 ft. high.

Usually mains have to be run from the engine room to the house, and are laid underground. For some reason, contractors usually favour V.I.R. conductors drawn into a screwed pipe, these conductors being sometimes lead covered. Care and experience is required in this class of work, the usual cause of trouble being a pipe line laid without a proper fall or any means of drainage, or the lead sheathing not being properly earthed, even if earthed at all, with consequent risk of corrosion and subsequent breakdown.

In country houses requiring only 50 to 80 lights, the main conductors which feed distribution boards can readily be run in pipe work chased into the main walls. In houses of larger size sometimes the architect provides a small trench, which runs right round the house, to contain the electric mains as well as the pipes required for the other services. Usually it is too limited in size, and often the hot and cold water services are so mixed up with the electric pipe lines that the latter are apt to suffer. A separate trench should be provided for the electric work only.

The mains between the engine room and house should be fused at each end.

Generally, there should be at least one distribution board for each floor, and the lighting fed from any board should be limited to the one floor or part of the house which it is intended to serve. The tendency is for the distribution board system to be much too limited and one has noticed, for instance, a small country house carrying about 100 lights fed entirely from one 10-way distribution board.

The wiring system mostly favoured, particularly for new property, is some class of pipe work, and in this grave errors are often made. A notable instance is the use of slip-socket tube laid under plaster work, which is objectionable. If welded or other absolutely closed tube is used, the point most commonly omitted is the proper earthing of all metal work.

Many contractors altogether ignore the question of voltage drop, so that when a small proportion of the lights are turned on or off a visible jump occurs to the lamps remaining on.

Tests properly carried out are mostly conspicuous by their absence. Not only should the work be tested on completion, but also at regular intervals afterwards, either quarterly, half-yearly or yearly, and a proper record kept of the results. The earthing should be tested as well as the insulation resistance.

Great conveniences can be obtained by proper methods of switch control, commonly known as 2-way and intermediate switching, by means of which a lamp or lamps can be turned "on" or "off" from any one of 2, 3, or more positions regardless of how the switches may have been left at the other positions.

These switches have been almost entirely developed by one firm (Messrs. A. P. Lundberg & Sons), to whom very much credit is due for the good results obtained. The art of multiple-way lamp switching has now become quite a big subject.

The automatic time-switch is of great advantage in securing economy in the use of electricity in the servants' quarters, where, unfortunately, waste will most freely occur. An ordinary lamp switch should be provided to short-circuit the automatic switch in case of emergency.

The scientific treatment of illumination is of great importance, but a compromise has to be struck, and in most cases the scientific treatment has to give way entirely to the so-called artistic tastes of those who will use the rooms. Certain cardinal points can often be adopted if one is tactful enough to avoid too much specific reference to them when advising the user.

Illumination tests are of immense value, practically as well as scientifically. Generally, the illumination must be somewhere between 1 and 2 ft. candles, but for local illumination, such as the dining table or the dressing table, more like 4 ft. candles are requisite, some persons preferring even 6, and for such a special purpose as the billiard table 12 to 15 ft. candles are considered more appropriate.

The Holophane Lumeter is exceedingly useful in taking measurements of illumination and for other photometric work.

ELECTRICITY APPLIED TO MINING.

By C. P. SPARKS, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *February 25th*, 1915.)

Progress during the last nine years has been so substantial that, in addition to the conversion of a large proportion of existing plant to electric drive, modern collieries are now entirely driven by electricity.

The present paper deals principally with the development of electric driving in the Powell Duffryn Collieries, which are raising coal at the rate of about four million tons per annum.

In 1905 the author described the Aberdare section of the Powell Duffryn undertaking, the power house then having a capacity of 3,000 kilowatts, the rating of the motors connected totalling 4,500 B.H.P., and the annual output being 4½ million units. The plant now in use by the company in the Aberdare and Rhymney Valleys is rated at 24,000 kilowatts, the motors being of 44,800 B.H.P., which represents something like 60 per cent. of the total power requirements. The output during 1914 was about 50 million units, and the estimated output for the present year is 62 million units.

The area worked by the Powell Duffryn Company is 16,000 acres. In the Aberdare Valley there are nine collieries, the distance from the power house to the furthest colliery being 2¼ miles; and in the Rhymney Valley six collieries, the distance of the furthest pit from the power house at Penallta being seven miles. The distance between the Middle Duffryn power house (Aberdare Valley) and Britannia Colliery (Rhymney Valley) is some nine miles.

After considering alternative advantages of main steam winding, the Powell Duffryn Company decided to drive the whole of the plant at the new Britannia Colliery electrically. The main winder house and the electrical equipment were erected before the sinking was started. The sinking was commenced in June, 1910, and the two shafts, each 22 feet in diameter, were sunk to a depth of 750 yards by September, 1913. This sinking was seriously impeded by the quantity of water met with, and for many months the continuous input for pumping alone averaged 1,000 kilowatts.

System.

Aberdare Valley—3,000 volts 3-phase 50 periods, neutral earthed.

Rhymney Valley—10,000 volts 3-phase 50 periods, neutral earthed.

Transmission—Aberdare to Rhymney, 20,000 volts 3-phase 50 periods.

Individual drive—Larger motors, 3,000 volts 3-phase; motors below 50 H.P., 500 volts 3-phase; lighting, 110 volts single-phase.

While no one system is completely satisfactory for every form of drive, in the opinion of the author the 3-phase 50-period system is more flexible than any other.

When a supply is available from a power company it should pay individual collieries to purchase the electrical energy required, and so avoid adding to the already multifarious duties of the colliery management, the necessity of supervising an electric power station. Where, however, the requirements of a single colliery undertaking exceed the output of the smaller power companies, it is advisable for such undertaking to generate its own electricity supply.

The use of exhaust-steam or mixed-pressure turbines has increased the field for separate generation. In other cases, coke-oven gas is available, which can be profitably utilised. Provided that the amount of power be sufficient and the colliery suitably located, joint working with a power company should be mutually advantageous in both the above cases.

With the increasing frequency and severity of labour troubles in recent years, the advantage of installing generating plant for pumping and ventilation at each important centre has become of increasing importance. In the case of the Powell Duffryn Company this point has been met by erecting as stand-by plant the original reciprocating sets which have been displaced from the main power house by larger plant, so that power may be available in an emergency at each main centre.

The generating plant, aggregating 24,000 KW., is distributed as under:—

Aberaman Valley.—Middle Duffryn Power Station.—One 5,000-KW. Escher Wyss-Siemens turbo-alternator; two 2,000-

KW. Escher Wyss-Westinghouse turbo-alternators; and one 2,000-KW. Curtis turbo-alternator, all running at 1,500 r.p.m.; total rating 11,000 KW.

Rhymney Valley.—Penallta.—Two 3,000-KW. mixed-pressure Westinghouse turbo-alternators at 1,500 r.p.m.; total rating 6,000 KW.

Bargoed.—Two 1,600-KW. Nuremberg gas engines driving A.E.G. flywheel alternators, and one 800-KW. set of the same type, running at 100 r.p.m.; one 2,000-KW. Fraser & Chalmers-Siemens mixed-pressure turbo-alternator at 3,000 r.p.m.; total 6,000 KW.

Elliot Pit.—Two 500-KW. Fraser & Chalmers exhaust-steam turbines driving Dick Kerr generators at 1,500 r.p.m.

At the Middle Duffryn power station water is drawn from the Cynon River, which has been dammed to form a cooling pond.

At Penallta the only source of circulating water is the pit. Originally the circulating water was cooled by sprays over a shallow pond; owing to the difficulty of keeping this pond watertight, through settlement due to the workings, the pond has been supplemented by two cooling towers by Messrs. Balcke, each having a capacity of 330,000 gallons per hour.

At Bargoed an ample supply of water is available from the Rhymney River, and at Elliot circulating water is cooled in spray coolers, make-up water being obtained from the pit or the Rhymney River.

The largest turbine unit at Middle Duffryn power house is the 5,000-KW. Escher Wyss-Siemens set, which has been in operation about nine months. The turbine is of the Zoelly 12-stage type, steam being supplied at the stop valve at 150 lb. per sq. in. pressure with 100° F. superheat and exhausting to a vacuum of 95 per cent. The plant is governed by an oil relay controlled by a governor, which actuates a double-seated throttle valve. Overload to the amount of 20 per cent. is obtained by means of a by-pass valve actuated automatically from the main governor and controlling live steam admission to the fourth stage. The turbine speed is regulated from the switchboard. The alternator is star-connected, for working with the neutral earthed through a resistance, and has the exciter armature mounted on an extension of the main shaft.

A fan on the rotor draws air from a wet-air filter through channels in the base of the stator and discharges it through an outlet in the top. The surface condenser, which has 12,800 sq. ft. of cooling surface, is immediately under the turbine; the turbine exhaust and the condenser are connected by a water-sealed gland.

The condensing auxiliaries consist of three centrifugal pumps, driven by vertical shafts from motors of the induction slip-ring type. The circulating water pump is driven by a 140-H.P. motor and the air and water extraction pump by a 75-H.P. motor, air being extracted by a jet of high-pressure water forced by the centrifugal pump through the air ejector.

The motors are connected at the floor level, so that in the event of the basement being flooded the auxiliaries could still be run, any water entering the basement being discharged by the opening of a valve on the circulating-pump suction.

Exhaust steam from existing winders and compressors is utilised at the following collieries:—

	Maximum rate of flow per minute.	Average per hour winding shift.
Elliot	— ...	50,000 lb.
Penallta	2,600 lb. ...	60,000 ,,
Bargoed	2,000 ,, ...	75,000 ,,

The first exhaust-steam plant was erected at Elliot Pit, and consisted of two 500-KW. exhaust-steam Rateau turbines and Dick Kerr alternators, steam being delivered from the main winders to two Rateau accumulators. The use of this plant is limited to the day shift, as it cannot be run efficiently on live steam.

The second application was at Penallta, where the exhaust steam from the two main winders and a compressor is utilised through two Rateau steam accumulators in conjunction with two 3,000-KW. Westinghouse mixed-pressure turbo-alternators. The turbines are designed to give an output of 1,800 kilowatts with 60,000 lb. of low-pressure steam, and when working mixed pressure to give an output of 3,000 kilowatts with 60,000 lb. of low-pressure steam and 19,000 lb. of high-pressure steam at 150 lb. per sq. in., 100° F. superheat.

As this plant works in parallel with the gas-engine station at Bargoed, close speed regulation was necessary, otherwise the gas-engine plant would have been over-loaded each time the plant changed from high-pressure to low-pressure steam. The makers were very successful in this application, tests showing that the alteration of frequency when changing from high-pressure to low-pressure steam did not exceed 0.3 of a period. The interchange of load when the gas-engine station is working at an average load of 1,800 kilowatts and the turbine load is 2,000 kilowatts does not exceed 500 kilowatts.

The condensing plant for each turbine is designed to deal with steam at the rate of 80,000 lb. per hour, the surface condensers having a cooling surface of 15,000 sq. ft. The condenser auxiliaries consist of an auxiliary steam turbine driving a Leblanc air pump, a centrifugal cooling-water pump, and a condensed-steam extracting pump running at 2,000 r.p.m. The auxiliary turbine, which develops 150 B.H.P., exhausts into the low-pressure steam system between the accumulator and the main turbine.

(To be continued.)

WAR ITEMS.

Birmingham Electrical Volunteer Force.—The following is a copy of a circular letter which has been issued this week:—"It is our pleasing duty to acquaint you with the purpose and constitution of the Birmingham Electrical Volunteer Force which was formed in Birmingham last November. It is a serious attempt to organise on a military basis for the purpose of Home Defence, all those connected with the electrical and allied industries in Birmingham who for sufficient reasons—which must entirely satisfy the Committee of Management—are unable to join the Regular Forces of the Crown. It is recognised that the members of the electrical and allied industries possess high technical knowledge and skill which only require a course of military training to become mobile and capable of effective military application. This is the work we are now engaged upon. The force is fortunate in its military advisers and instructors, and the Committee of Management is composed of men who are prominent in local engineering circles. Two large drill halls are occupied three nights each week for manual training; dummy rifles and miniature range rifles have been purchased and a rifle range has been secured. The following sections have now been organised:—Air Line, Cable Line, Wireless, Signalling, Searchlight, Fortress, Works, Motor Transport, Electric Transport, etc. A room has kindly been placed at our disposal in the Central Technical School, where a series of lectures will be given on military engineering. It is hoped that the force will soon be 1,000 strong, and efficiently prepared to take its part in the defence of our country should the necessity arise. In order to make it easy for manual workers to join us, the subscription has been fixed at a nominal figure, and we have no hesitation in asking for your generous support of the movement, which so closely concerns us all. A sum of £1,000 is required immediately for the provision of the equipment necessary to enable the force to attain military efficiency. The War Office have decided that no grants will be given by them and that all volunteer corps must be self-supporting. Most of our members are working men who are not in a position to contribute more than the nominal subscription already fixed. In these circumstances and owing to the expensive nature of the equipment required for a technical force, it is essential that outside assistance should be obtained.

"The undermentioned donations have already been promised:—General Electric Co., Ltd., £100; Callender's Cable Co., Ltd., £100; Babcock & Wilcox, Ltd., £50; George Ellison, Esq., £50; W. & T. Avery, Ltd. (Automatic Dept.), £25; R. A. Chattock, £10; Donovan & Co., £10; S. R. Hare, £5; D. Shanks, £5.

"The Treasurer will gratefully acknowledge your donation.

"R. A. CHATTOCK, President.
"DAVID SHANKS, Chairman.

"14, Dale End, Birmingham.
"March, 1915."

Russia: Trade Routes.—In view of the existing difficulties in shipping goods to and from Russia, the following extract from an American report just issued will be of interest:—"Freight for Russia, which has been going into Archangel and thence by rail via Vologda to Petrograd, can probably not be landed there any more until next summer, because, notwithstanding all the efforts of icebreakers to keep the White Sea open, the harbour of Archangel is now reported to be frozen solid from two to four feet thick. As there is a great accumulation of freight now at that port awaiting rail transportation, it will probably not make much difference for several months. New interest is being taken in the all-rail route from eastern Scotland or England ports to Bergen, Norway, thence to Christiania, Stockholm, Boden, Tornea; thence south through Viborg to Petrograd. There is, however, a gap in the northern portion of this route. This reaches from Tornea to Karungia, say 15 to 20 miles. I met a man a few days ago who had just come over that gap. He said that there was good sledding, enabling freight to be transported now very easily in that manner. He said it took him six days to go from Petrograd to Stockholm. This route, however, ought to offer good attractions for shipment of American freight of any kind to Russia. American ships might run to Peterhead, Scotland, or to Newcastle, and thence to Bergen; or they might, of course, run direct to Bergen. It is reported that a new steamship line is arranging to run between Stavanger, Norway, and some point in England. No doubt this service could be utilised for a certain amount of American package freight, shipped primarily to Liverpool, and going over this route to Bergen for the all-rail route to Russia. In making arrangements for handling this new Russian traffic it is well to remember that our trade with Sweden is rapidly increasing, and the same arrangements for carrying through Russian traffic could be utilised for this growing Swedish business."

A New Veto on German Electrical Exports.—A further extension of the many existing prohibitions has now been made by the German Government by the imposition of a veto on the export trade and transit trade in the following classes of electrical manufactures:—(1) Dynamos, motors, converters, transformers, choking coils, and complete armatures and commutators if they are intended for ships, search-

lights and installations for wireless telephony and telegraphy; (2) copper wire, cable and strands, aluminium and alloys of aluminium, plain or covered and with or without an outer metallic armouring; also flexible insulated wires of short length which, as component parts of electric lighting manufactures, are connected with these, or which are provided with contact devices at both ends; (3) searchlights and their constituent parts, excepting so-called projector lanterns; (4) carbons; (5) contrivances for telephony and telegraphy and for wireless telephony and telegraphy, including component parts, excepting telephone, wall and table installations; (6) telegraph standards and other masts for conductors, made of wood; (7) those component parts of installations of conductors for telephony and telegraphy, which in themselves are not subject to prohibition, if they are intended for such installations; (8) pocket lamps, hand lamps and torches and the batteries and accumulators suitable for them, and constituent parts of the same; (9) glow lamps and their component parts; (10) special apparatus for the transmission of orders and compass movements, and their constituent parts; (11) mines and ignition apparatus, together with magnetos; and (12) all electrical products not specially prohibited, if they are goods which fall under the veto on imports, exports and transit trade from the standpoint of their material nature or according to their use.

Thermit, Ltd.—We have been asked to publish the following statement:—"By order of the High Court upon application by the Board of Trade, I have been appointed Controller of Thermit, Ltd., as it appeared to be in the public interest that the company's business should be continued without interference. In view of my appointment, which does not in any way reflect upon the management of the company in this country—as was stated by counsel for the Crown in open court—I am in a position to assure you that no moneys or profits will reach the alien enemy shareholders of the company. As regards the patents, the Board of Trade have decided to avoid two patents belonging to the company, viz., Nos. 10,859/01 and 24,439/02, the first of which would, in any case, have lapsed in about three months from now, and the second about a year after. The company, however, do not regard the loss of these patents as a very serious matter, as for modern practice welding they rely on a number of subsequent improvements, besides certain secret knowledge which will enable them to deliver material of exactly the same welding properties as they have hitherto supplied. All materials, etc., required for rail welding are manufactured in the company's works, at 675, Commercial Road, London, E., and both the office staff and workmen employed are exclusively of British nationality.

"ARTHUR TAYLOR, Controller.
"Hudson, Smith, Briggs, Smith & Taylor,
"Chartered Accountants,
"London and Bristol."

Glow-Lamp Manufacture in Holland.—The annual report of Philips Gloeilampen Fabrieken, of Eindhoven, which is one of the largest works in the world, is stated to show gross profits of £208,000 for 1914, as compared with £149,000 in the preceding year. It is proposed to appropriate £60,800 for depreciation of machinery, as against £54,000 in 1913, and £28,000 for depreciation of works and buildings as contrasted with £24,000, and to set aside a further sum as provision for war risks in relation to debts owing to the company. The balance of net profits amounts to £106,000, as against £66,000 in 1913, and the directors recommend dividends of 7 per cent. on the preference capital of £187,000, and 11 per cent. on the ordinary capital of £291,000, being the same rates as in the previous year. As compared with the total capital the balance sheet is noteworthy from the standpoint of the large amounts allocated to depreciation, and from the holding of £295,000 in cash, first-class securities, etc., as against £138,000 in 1913.

The War Office and Messrs. Siemens.—A question was asked in Parliament on Monday, by Mr. R. Gwynne, with reference to the placing of War Office contracts with Messrs. Siemens. In reply, Mr. H. Baker said that such contracts were given to the firm named, and he was aware of the constitution of the board. The firm employed a very large staff of British workers, and had given an undertaking that no part of any payments received on War Office contracts would be transmitted to enemy shareholders. He was informed (says the "Times" report) that there were no British-owned firms not already engaged on Government work who were capable of undertaking the contracts which this firm had received. In the circumstances, he did not think it was in the public interest to dispense with the firm's services. He believed it was an absolutely trustworthy firm.

If Mr. Gwynne, and indeed every other member of the House of Commons, were to read the ELECTRICAL REVIEW, the time of Parliament now spent in answering unnecessary questions would be saved.

Coal Prices.—Coal merchants have given notice to Darwen Electricity Committee that, owing to the reduction of the output of coal through workmen enlisting, they are compelled to reduce the supply by 25 per cent., and that any coal delivered over 75 per cent. of the contract quantity will be charged at the rate of 1s. 6d. per ton above the contract price.

More Diabolical Ingenuity of the Enemy.—In the "Wireless World," it is stated that the German trenches are being protected by barbed wireless. Terrible havoc has been wrought through our troops marching into it without seeing it.

Signal Service 1st London Divisional Engineers.—A third Signal Company will shortly be raised. Applications to enlist are required from young well-educated electrical engineers or electrical engineering students. Applicants should possess a practical working knowledge of some branch of the electrical industry or have studied at some technical institute. The work of the company being of a highly technical nature, the experience gained after some months' service renders a man better qualified for appointments in civil life. Most of the men are mounted, but those unable to ride will be taught. The pay and allowances are at the special Royal Engineers' rates, with separation allowance to dependents. Applications for enlistment should be made, in the first place in writing, to the Recruiting Officer, c/o O.C. 2/1 London Divisional Signal Company, 10, Victoria Park Square, Bethnal Green, E.

Uruguay-German Enterprise.—In a recent report to his Government the American Consul at Montevideo states that German competition in that market is still an important factor, though at the beginning of the war it was generally assumed that German trade with South America would be practically suspended. There was an ample supply of German manufactured articles in Montevideo at the beginning of the war, and goods shipped from Germany since the war started are stated to have been offered in Uruguay at competitive prices. The German importing houses and industrial enterprises in the country are expected to serve as effective bases for trade operations after the war, as they did before, and the Germans are quietly making necessary preparations for re-establishing their old business and trade relations as soon as peace is declared.

Australia and German Trade.—From various reports to hand it is apparent that the movement in Australia for avoiding future trading with Germany, and giving substantial preferential treatment to British and Allied countries, is gathering force. A permanent transfer of trade connections from Germany is what is being aimed at, and statesmen and others are not hesitating to say that whatever may have been their views in the past. the war has taught the necessity for considering our own people first.

War Bonus.—The Potteries Electric Traction Company have intimated that men in their employ will receive 2s., and boys 1s., weekly bonus while the war lasts.

Personal.—Included in the first batch of English wounded prisoners exchanged for German prisoners, were Private J. Hopwood, of Astley Street, Dukinfield, and Private Willie Edwards, of Hurst, both of whom were up till recently employed at the Tudor Accumulator Works at Dukinfield.

Accrington Electricity Committee, after considering what to pay Captain Gray, the chief electrical engineer, during the time he is serving in the new Howitzer Brigade, recommends the Council to supplement the captain's army pay by such sum as will make it equal to his salary as chief engineer, and to continue such a rate of payment during the war.

Mr. Wilfrid Gonde, electrical engineer, of Alverston (Lancs.), has joined Kitchener's second army, being recruited at Cambridge.

Roll of Honour.—Sergt. Stephen Gilbert (24), of the King's Royal Rifles, formerly employed at the United Electric Car Works, Preston, has died at Gustrow, Germany.

Wm. Hy. Hunt, a private in the Royal Marine Light Infantry, a former employé of Blackpool and Fleetwood Tramroad Co., is stated to have been among the crew of the armed liner "Clan McNaughton," reported by the Admiralty to have been lost with all hands.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Government and Foreign Trade.

Referring to your remarks under this heading on page 848 of your issue dated December 25th, it is with great satisfaction that this Committee has seen this matter taken up by such an important institution as the British Engineers' Association.

This Committee, although formed for the express purpose of sending home volunteers for Lord Kitchener's Army, has also been giving attention to trade questions, and this matter has been under study for some time. We are entirely in agreement with the chairman of the British Engineers' Association that reforms are required in the Consular service if British trade is to be properly looked after in the future.

A great many instances could be cited from this country alone to show how British foreign trade has been neglected in the past, and it is the hope of this Committee that some measures will be taken that will ensure the proper attention being given to this very important matter.

We have no hesitation in saying that the need for reform is felt by British trade throughout the world, and advantage should be taken of the present patriotic awakening to ensure that we do not fall again into the state of indifference existing before the outbreak of war.

Small British communities abroad can do very little more than appeal to those at home, and we trust that all the important journals, such as the Electrical Review, will take this matter up seriously, and put it before the public authorities in such a way that it will be thoroughly inquired into and dealt with without delay.

Wm. Johnston, M.I.E.E.,
Hon. Secretary, British Patriotic Fund.

Santiago, *January 28th*, 1915.

Consulting "Engineers."

I think "Station Engineer" has voiced a complaint that does need immediate attention, but he does not go far enough, for what about cases like this (I can vouch for it). There is a large institution, having extensive works up and down the country, where the chief engineer has never been inside a works in his life, has absolutely no practical knowledge, and could not even point out with any degree of certainty which is the positive terminal of a Leclanché cell. This "engineer" has the preparation of schemes and specifications for electrical and mechanical work. The contractors know this, and have a good time at the firm's expense, for work is not inspected by an engineer who knows his job, although there are some in the office who do, and it is thanks to these men that he is able to "get through." Could nothing be done to make it necessary for positions like these to fall to men who have qualified for such? for there are many who have spent years and a fortune in training.

Ero.

Batteries for Electric Vehicles.

Perhaps you would be good enough to find space for some comments of ours on the recent article appearing in the *Commercial Motor* on the "Choice of a Battery." As pioneers of the commercial electric vehicle in this country, we naturally feel astonished that after the Edison accumulator has been on the market for seven years it should be possible for the writer of the article in question to fall into so many serious errors of fact.

First, concerning some of the *Commercial Motor's* general statements. The lead battery is certainly not the more popular one for electric vehicles in Great Britain, as there are, in fact, about 90 per cent. of all the commercial electrics in this country equipped with the Edison accumulator, as against 10 per cent. with other types.

One concern alone will shortly have nearly 50 Edison accumulator vehicles, having started only about two years ago with a single van. There should be no special difficulty in deciding what type of battery to employ, if it is required to run an electric vehicle at the least possible expense. Where an electric vehicle is in constant and reasonably vigorous service, we assert that the Edison accumulator offers the nearest solution to the problem of economy. Our reasons in support of this statement we have adduced on numerous occasions, and we shall be willing to quote actual figures, which we would guarantee for a given set of conditions, to any *bona fide* inquirer.

Referring to lead batteries in general, it is a fact that no lead battery whatever, excepting the "Ironclad" Exide, is sold with a guarantee in this country. As a battery is mentioned which is sold with a guarantee of two years, we conclude that this one must be the "Ironclad" Exide. The guarantee in this case warrants 80 per cent. of the rated capacity after two years' service. The majority of lead batteries will not give more than from 8,000 to 10 000 miles service, under commercial conditions, and even then must be exceedingly well looked after during the whole of their lifetime, to prevent the injurious sulphation, which, at very slight provocation, will quickly ruin such batteries.

The next statement is unprecedented in our experience of the many extremely inaccurate statements that have appeared, with regard to the Edison accumulator. It should be well known by now that the inherent chemical principle on which the action of the Edison cell is based, preserves it completely from all but the slightest traces of deterioration on open circuit, and that, therefore, the *Commercial Motor's* statement that "the Edison must of necessity be replaced at the end of four years, whether it has been used or not" could not be more inaccurate. In point of actual fact, the Edison cell is warranted, without reserve, for electric vehicle service, that after four years' daily operation in a commercial electric vehicle, it will give 100 per cent. of its normal rated output and efficiency, and will, moreover, during the interim cost nothing whatever for mechanical repairs—that is, no plate renewals or upkeep. If the Edison cell be allowed to remain on open circuit, then the amount of deterioration that occurs is nil; if only used for a few cycles of charge and discharge per annum, its life will undoubtedly be indefinite, running, perhaps, into 40 or 50 years, though this cannot be positively proven by quoting practically-derived figures, as the modern type of Edison cell has only been commercially available for seven years.

Concerning life, we do, however, positively know that in cases where Edison accumulator-equipped trucks have been in service five years, having run 50,000 miles during that time with the same set of batteries, the latter have shown no signs of depreciating below their normal capacity, but have, on the contrary, given more than 10 per cent. above rating at the end of this period. Is a battery worn out, after four years, which shows 10 per cent. above rating after five years? The Adam Express Co., in the United States, which has 800 of its cars equipped with the Edison accumulator, could and would, no doubt, give some first-hand information on its reasons for choosing this type in preference to others which, as the *Commercial Motor's* article states, should for all-round work be the better proposition.

It is quite true that most lead accumulators maintain their voltage better on very high rate discharges, that is, when going up hill, but against that must be set the fact that especially towards the end of discharge, it is extremely detrimental to the lead type of cell to take high currents therefrom, as this causes not only buckling of the positive plates and shrinking of the negatives, but also severe sulphation, unless the cells be charged soon after receiving such maltreatment. Contrast this with the nickel-iron Edison cell, which may be completely short-circuited and left out of commission, should that be necessary, for an indefinite period, without being in the least harmed thereby.

Referring to weight, the annexed table indicates the ratio of weights of the Edison cell, compared with two of the best known makes of lead accumulators. These figures are taken from data supplied by the manufacturers themselves, through the medium of the Electric Vehicle Association.

Make of battery.	Rated KW.-hr. output.	Gross weight in lb.	Weight in lb. per KW.-hr. at rating.	Excess of weight over Edison type.
Ironclad	10·6	1,350	127	53 %
El. S B. Co. thin plate	12·8	1,350	105	28 %
Edison A-4... ...	10 8	900	84	—
Ironclad	13·2	1,620	123	50 %
El. S B. Co. thin plate	17·1	1,720	100	22 %
Edison A-5... ...	13·5	1,100	82	—
Ironclad	18·5	2,200	119	45 %
El. S.B. Co. thin plate	21·4	2,100	98	19 %
Edison A-6... ...	16·2	1,260	78	—
Ironclad	23·8	2,750	115	40 %
El. S.B. Co. thin plate	27 8	2,650	96	17 %
Edison A-8	21·6	1,820	84	—
Ironclad	26·4	3,080	117	43 %
El. S.B. Co. thin plate	32·1	3.080	96	17 %
Edison A-10 ...	27·0	2.250	84	—
Edison A-12 ...	32·4	2,700	84	—

Note.—The weight characteristic taken above for the Edison cell is a conservative figure of 82 lb. per KW.-hr. In actual practice this is generally considerably less, viz., about 75 lb. per KW.-hr.

As to re-charging, although the constant-potential method, involving a steady pressure of 2·3 volts per cell, is frequently advocated by the lead-battery makers, and is, no doubt, very good for ensuring the longest possible life of this type, it should not be forgotten that the procedure is a lengthy one, taking from 11 to 13 hours, and even then does not achieve a complete charging effect, it being necessary to supplement the constant-potential charging by over-charging once a week or thereabouts. Moreover, the lead type of cell, without exception, is not improved by boosting, carried out under conditions such as generally obtain in everyday service. That is, boosting must be kept below the rate at which violent gassing is produced, else the lead type of cell is greatly injured thereby and its life reduced. With the Edison cell, gassing is unimportant, from a destructive standpoint, and merely signifies the wasting of a small amount of current. In fact, boosting rates are possible with the Edison cell, which would after, say, six months' service reduce the majority of lead cells to a heap of lead oxide in the bottom of their containers.

From the above it is clear that the actual service life of the Edison cell may be expected to be far in excess of that indicated by the guarantee period.

Further advantages in favour of the Edison cell lie in its perfect immunity from the effects of long-continued mechanical vibration and the consequent injury occasioned, not only to the plates, but to the containers. Obviously a container made of rolled steel plate with a welded seam is a better mechanical job than any ebonite or rubber compound container could be. Moreover, the Edison cell uses a steel-preserving electrolyte, in the place of acid, thus eliminating a whole train of minor disadvantages which often prove a great nuisance under practical conditions. Anybody who has "suffered" from sulphuric acid will agree hereanent.

Whilst the general upkeep of the Edison cell involves merely charging as and when required, and the occasional addition of distilled water, together with the simple precaution of not allowing the exterior of the cells to become dirty and wet, the procedure in the case of the lead battery is relatively complex and includes a large number of "don'ts" and precautions which may be completely ignored when operating a steel battery. It is also simpler to determine the state of charge and discharge of an Edison cell, since it is a property of the nickel iron type that its ampere-hour capacity is more or less constant, within practical limits, at all rates; energy withdrawn from an Edison battery may be determined merely by measuring the ampere-hours withdrawn by means of an integrating ampere-hour meter. If this instrument be set to run slower on charge, by an amount slightly exceeding the difference between 100 per cent. and actual ampere-hour efficiency, then the readings of such an instrument represent safely, at any given moment, the state of charge or discharge of the battery, and no considerations as to voltage, &c., are necessary. An Edison cell is quite unharmed by being discharged to complete exhaustion. It may be left in that state for long periods, and does not suffer in consequence.

We are, of course, prepared by all the usual means to justify the remarks made in this communication, and shall be glad at any time, either personally or through the Press, to substantiate the claims which we herewith make.

For **Edison Accumulators, Ltd.,**
Raymond J. Mitchell, *Commercial Engineer.*

London, S.W., *March 1st*, 1915.

Trouble with Oil.

Referring to the letter of "Inquirer," in your issue of February 26th, *re* a 1,000-KW. D.C. set driven by a Belliss & Morcom engine throwing oil, a few months ago we were experiencing the same trouble with a set of the same make. After having come to the same conclusion as "Inquirer," that the oil was carried in in the form of vapour, and after trying endless devices for preventing the collection of oil in the armature, the idea of a fan was struck upon.

An out-throwing fan driven by a 1½-H.P. motor was fitted in the wall about 14 ft. above the top of the engine cylinders, and 8 ft. away, which gave excellent results.

The set has been running on and off for the last 12 months, and for the last 9 months we have had no trouble with oil collecting or creeping, and the shaft is always perfectly dry.

It is obvious that in the construction of large modern dynamos, the ventilating air-space being so large, a set running at 250 to 300 R.P.M. will create a vacuum inside the armature, and draw in oil vapour from the engine room, which is thrown up through the armature windings, thus forming, if allowed to remain, a thick coating of grease and dust.

Trusting that this information will be of some use to "Inquirer."

Charge Engineer.

Referring to the letter of "Inquirer," I experienced a similar difficulty some little time ago on a somewhat smaller set, and found that the trouble was caused by oily vapour from the H.P. glands of the engine. This vapour rose above the engine, and ultimately was drawn into the generator at the commutator end. The difficulty was overcome by fitting new packing, and by careful attention being paid to the glands.

W. H. B.

Electric Light Switching.

The results of the electric light switching competition, published in last week's issue of the electrical Press, make interesting reading.

There is one outstanding feature, however, which illustrates how the "art of switching" is coming to the fore not merely as a novelty but as a means of efficiently controlling various electrical apparatus—that the various Polytechnics are giving greater attention to the subject.

The recent list contains the names of no fewer than 17 students of the South-Western Polytechnic, who have succeeded in gaining between them one cash prize, five book prizes, and 17 certificates.

East Ham Technical College students obtained one book prize and three certificates.

W. E. S.

Writer's Cramp.

I shall be very much obliged if any reader can advise me regarding the proposed use of an electrically-operated massage vibrator or induction coil or continuous-current battery, in the following case:—One of my clerks, who for some few years past has had to confine his handwriting during office hours largely to signing his own name and initials, now experiences some pain in his wrist when writing—whether it be his name or an ordinary letter. His hand twitches so much at times that it is frequently difficult for him to sign his name neatly.

I understand that electrical treatment has been found of much use in cases of this kind, and if anyone could state from experience the result of such treatment by either of the means suggested above, it would be very greatly appreciated.

W. H. B.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

COLOMBIA.—A decree of December 4th, 1914, effective from January 1st, 1915, increases the river tax on goods transported on the Magdalena River between Barranquilla and the interior of Colombia. The new rates are $4 in place of $2 per metric ton (2,204·6 lb.) on imports, and $1.60 instead of $1 per ton on native exports. In view of this increase in the river tax and the fact that Customs duties in Colombia are collected on gross weight, shippers to the interior of Colombia will see the advantage of combining lightness with strength in the packing of their merchandise.

SPAIN.—In a cablegram to the United States Governments from Madrid dated January 27th, Commercial Attaché C. W. A. Veditz, of the American Department of Commerce, reports that on that date the Spanish Government appointed a new tariff Commission to prepare for tariff revision. It is provided in the Customs tariff law of Spain that the rates of duty shall be revised every five years, in order to take into account the changes in the values of merchandise on which the duties are based. The latest revised tariff became effective on January 1st, 1912, and it is assumed that the revision entrusted to the present newly appointed Commission will go into effect five years from that date.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,356. "Means for intermittently starting and stopping as desired electrical machines." W. Brown. February 15th.
2,370. "Switch fuse-box with endless fuse wire and incombustible non-conducting core." J. Kluytmans. February 15th.
2,386. "Electric switches, circuit breakers and the like." British Thomson-Houston Co., Ltd. (General Electric Co., United States). February 15th.
2,387. "Electric liquid heater of the water-flow service supply type." A. Howard. February 15th. (Divided application on 10,930/14, July 11th.) (Complete.)
2,388. "Portable electric lamp stands." Wallace Novelty Co. February 15th. (Complete.)
2,390. "Meters for multi-wire circuits." F. A. Nield. February 15th.
2,404. "Electro-magnetic driving mechanism." T. Rushton. February 15th.
2,433. "Process for the manufacture of finely-divided metals." S. O. Cowper Coles. February 16th.
2,434. "Coating metallic surfaces with zinc." S. O. Cowper Coles. February 16th.
2,435. "Process for the production of a rustless tinned sheet." S. O. Cowper Coles. February 16th.
2,444. "Electrical heating and cooking apparatus." G. W. L. Patterson. February 16th.
2,456. "Electric lamp for reading despatches and other printed matter, applicable also for signalling purposes." A. W. J. Sheldrake. February 16th.
2,462. "Connections for the practically sparkless interruption of an electric circuit." Fried. Krupp Akt. Ges. (Convention date, February 19th, 1914, Germany.) (Complete.) February 16th.
2,488. "Lamp shades." H. J. C. Forrester (J. W. Dunham, United States.) February 16th. (Complete.)
2,489. "Portable electric lamps." H. J. C. Forrester (J. W. Dunham, United States.) February 16th. (Complete.)
2,490. "Starting means for electric motors." W. J. Sheppard & G. A. Yarwood. February 16th. (Complete.)
2,516. "Magnetic-impulse motors." W. E. Clifton. February 17th.
2,532. "Controllers for electric lifts." C. G. Major & Smith, Major & Stevens, Ltd. February 17th.
2,535. "Dynamo-electric machines." B. G. Lamme. February 17th. (Convention date, February 19th, 1914, United States.) (Complete.)
2,546. "Electric fires." H. H. Berry & W. J. Markham. February 17th.
2,565. "Wireless telegraphy and telephony." J. Perry & S. G. Brown. February 17th.
2,570. "Means for protecting and indicating the condition of electric circuits." F. S. Grogan & British Electric Transformer Co., Ltd. February 17th. (Complete.)
2,574. "Electro-magnetic rectifiers." H. J. Dale. February 18th.
2,618. "Dynamo-electric machines." Crompton & Co., Ltd., & N. Pensabene. February 18th.
2,619. "Electric starters for internal-combustion engines." A. H. Midgley & C. A. Vandervell. February 18th.
2,624. "Rotors of dynamo-electric machines." Sunderland Forge & Engineering Co., Ltd., R. G. Scott, & A. T. Robertson. February 18th.
2,636. "Electric ordnance." T. G. Tulloch. February 18th.
2,651. "Lamps for electric lighting." J. T. Sutcliffe. February 19th.
2,656. "Electric resistances." Simplex Conduits, Ltd., & F. F. D. Davidson. February 19th.
2,676. "Electro-magnetic projecting or transmitting apparatus." E. Bachelet. February 19th.
2,685. "Electro-magnetic projecting or transmitting apparatus." E. Bachelet. February 19th.
2,687. "Electric batteries." J. Sutton & G. J. Sutton (trading as Stuart & Moore). February 19th.
2,696. "Tubular electric pocket-lamps." E. C. R. Marks. February 19th. (Interstate Electric Novelty Co., United States.) (Complete.)
2,697. "Maximum cut-outs." G. Jacobus van Swaay & H. I. Keus. February 19th. (Convention date, February 25th, 1914, Holland.) (Complete.)
2,698. "Method of rendering articles made of porcelain, pottery, glass and the like, electrically conductive for the purpose of enabling the deposition thereon of metallic coatings by electrolysis to be effected." P. Marino. February 19th.
2,750. "Magnetic compass." James A. Sinclair & Co., Ltd., & A. Snell. February 20th.
2,762. "Incandescent electric lamps." T. Green. February 20th.
2,766. "Means for preventing discharges from electric conductors." C. B. Burdon. February 20th. (Siemens-Schuckertwerke G.m.b.H., Germany.)
2,767. "Manufacture of electrodes suitable for electrolytic or analogous purposes." Siemens & Halske Akt. Ges. February 20th. (Addition to 605/09. Convention date, February 21st, 1914, Germany.) (Complete.)
2,786. "Transformers." J. Torner. February 20th. (Convention date, February 21st, 1914. Spain.) (Complete.)
2,787. "Electrical press-button switches." E. Ottinetti. February 20th. (Convention date, February 23rd, 1914, Italy.) (Complete.)
2,789. "Electro-deposition of metals on china, earthenware, porcelain, glass, and like non-conducting surfaces." B. G. Clark. February 20th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

24,028. Manufacture of Tungsten. C. Gladitz. October 23rd.
26,353. Manufacture of Diamond Dies for Drawing Metals. C. Gladitz. November 17th.
29,274. Current-carrying Coils for Electro-magnetic Apparatus. J. W. Ewart. December 19th.

1914.

1,395. Methods of Protecting Electric Feeders and the like. E. G. Waters. January 19th.
2,327. Dynamos. H. Leitner. January 28th. (Cognate application 12,455/14.)
2,431. Lamp Shades or Reflectors. M. H. Galsworthy. January 29th.
2,543. Telephone Systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co.). January 30th.
2,604. Electrical Heating Apparatus suitable for Cooking, Water-heating, and like purposes. A. F. Berry. January 31st. (Cognate application, 17,762/14.)
2,605. Means or Apparatus for Heating Water and other Liquids. A. F. Berry. January 31st
2,691. Apparatus for Controlling Motors from a Distance. A. Mond (Maschinenfabrik Oerlikon). February 2nd.
2,808. Electric Bells. W. M. Thornton. February 3rd.
3,455. Centrifugally-regulated Dynamo-electric Clutch. W. Morrison. February 10th.